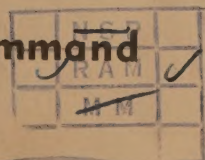


**Queensland
Department
of Agriculture
and Stock**

ANNUAL REPORT 1958-59

Presented to Parliament by Command



Brisbane: By Authority S. G. REID, Government Printer.



The Honourable,

The Minister for Agriculture and Stock.

Dear Sir,

I have the honour to submit herewith the annual report of the Department of Agriculture and Stock for the year ended June 30, 1959.

The first portion of the report comprises an overall review of the various industries and the major activities of the Department, and this is followed by a more detailed account of the work undertaken during the period under review.

Yours faithfully,

W. A. T. SUMMERVILLE,

Director-General.

ORGANISATION OF THE DEPARTMENT AS AT 30th JUNE, 1959

MINISTER FOR AGRICULTURE AND STOCK Hon. O. O. Madsen, M.L.A.

CENTRAL ADMINISTRATION AND CLERICAL AND GENERAL DIVISION—

Director-General and Under Secretary W. A. T. Summerville, D.Sc.
Deputy Director-General W. Webster, B.V.Sc.
Assistant Under Secretary W. T. Gettons, A.I.C.A.
Special Administration Officer H. Barnes.
Officer in Charge, Information Services C. W. Winders, B.Sc.Agr.
Accountant E. C. R. Sadler, A.A.U.Q.

DIVISION OF PLANT INDUSTRY—

Director of the Division W. J. S. Sloan, M.Sc.Agr.

Agriculture Branch—

Director of Agriculture L. G. Miles, B.Sc.Agr., Ph.D.

Horticulture Branch—

Director of Horticulture S. A. Trout, M.Sc., Ph.D., F.R.A.C.I.

Regional Experiment Stations Branch—

Director of Regional Experiment Stations W. J. Cartmill, M.Sc., A.R.A.C.I.

Science Branch—

Sections of Botany (S. L. Everist, B.Sc., Government Botanist); Entomology (W. A. McDougall, D.Sc., Government Entomologist); and Plant Pathology (J. H. Simmonds, M.B.E., M.Sc., Government Plant Pathologist).

Chemical Laboratory—

Agricultural Chemist C. R. von Stieglitz, F.R.A.C.I.

DIVISION OF ANIMAL INDUSTRY—

Director of the Division A. L. Clay, B.V.Sc.
Assistant Director C. R. Mulhearn, B.V.Sc.

Veterinary Services Branch—

Director of Veterinary Services C. R. Mulhearn, B.V.Sc.

Pathology Branch—

Director L. G. Newton, B.V.Sc.

Biochemical Branch—

Biochemist J. M. Harvey, D.Sc., A.R.A.C.I.

Husbandry Research Branch—

Director of Husbandry Research J. W. Ryley, B.V.Sc.

Sheep and Wool Branch—

Director of Sheep Husbandry A. T. Bell, B.V.Sc.

Cattle Husbandry Branch—

Director of Cattle Husbandry D. N. Sutherland, B.V.Sc.

Pig and Poultry Branch—

Sections of Pig Husbandry (F. Bostock, Senior Pig Husbandry Officer); and Poultry Husbandry (F. N. J. Milne, B.Sc., Senior Poultry Husbandry Officer).

DIVISION OF DAIRYING—

Director of Dairying E. B. Rice, Dip.Ind.Chem.

Field Services Branch—

Director of Field Services F. C. Coleman, Q.D.D.

Research Branch—

Director of Research L. E. Nichols, B.Sc.Agr., A.R.A.C.I.

DIVISION OF MARKETING—

Director of Marketing H. S. Hunter.

Marketing Branch—

Director of Marketing H. S. Hunter.

Economics Research Branch—

Director of Economic Services C. H. P. Defries, H.D.A., B.Com., A.F.I.A.

Standards Branch—

Standards Officer A. A. Ross, M.Agr.Sc.

CONTENTS

	Page
GENERAL REVIEW.—	
Seasonal Conditions; Industry Situations and Trends; Pastures; Brigalow Control; Soil Conservation; Facilities for Research; and Staff	1
DIVISION OF PLANT INDUSTRY	19
Agriculture Branch	20
Horticulture Branch	30
Regional Experiment Stations Branch	37
Botany Section	45
Entomology Section	47
Plant Pathology Section	49
Chemical Laboratory	51
DIVISION OF ANIMAL INDUSTRY	54
Veterinary Services Branch	55
Pathology Branch	60
Husbandry Research Branch	65
Biochemical Branch	68
Sheep and Wool Branch	71
Cattle Husbandry Branch	74
Pig Section	79
Poultry Section	82
DIVISION OF DAIRYING	85
Field Services Branch	87
Research Branch	92
DIVISION OF MARKETING	99
Marketing Branch	99
Economics Research Branch	100
Standards Branch	101
CLERICAL AND GENERAL DIVISION	105

REPORT OF THE DEPARTMENT OF AGRICULTURE AND STOCK FOR THE YEAR 1958-59

TO THE HONOURABLE THE MINISTER FOR AGRICULTURE AND STOCK

GENERAL REVIEW

The year 1958-59 did not vary greatly from normal, except that the drought conditions noted in last year's report continued in most of the south-west and have not yet been greatly relieved.

Seasonal conditions throughout the period were generally favourable for agricultural and horticultural crops. Rainfall in the farming districts was reasonably well distributed and the winter periods were relatively mild.

Rainfall in June 1958 was well above average in all the major farming areas. This produced conditions favourable for rust attack in cereal crops, and most susceptible varieties of wheat and oats were affected. July was a dry month, but rains in August kept winter crops growing satisfactorily. The southern Darling Downs and the South Coast received further useful rain in September, and October rains on the Darling Downs and in the South Burnett enabled some planting of summer crops to proceed. Fine, hot weather in November afforded excellent harvesting conditions for the winter grain crops. Storms in December yielded useful widespread falls.

Two cyclones in January benefited most of the State, but flood damage was caused in northern districts. An intense cyclone in February caused severe damage to crops in the Bowen-Proserpine area due to high winds. This cyclone changed into a rain depression that brought heavy falls to the Central Highlands, parts of the Darling Downs and the Lockyer, causing flash floods and erosion damage. March was generally dry and provided good conditions for harvesting early plantings of maize, peanuts and grain sorghum. General rains fell at the end of the month and in many areas provided suitable planting rains for winter grazing crops. Severe hail, followed by heavy rain, in the Granite Belt damaged late apples and the grape crop. April was generally fine and absence of frosts in that month and in early May enabled late-planted summer grains to fill. May was generally showery and winter grazing crops got away to a good start. June rainfall, however, was generally well below normal. The northern wet season was unduly prolonged.

After two years of generally adverse seasonal conditions in the dairying districts, the past year opened well with widespread June rains. From then until December rainfall was spasmodic and in some districts was below average. Most districts benefited from widespread thunderstorm activity in December and production rose sharply. Adequate rainfall was received in January and February, but in the remaining months, except

May, conditions were fairly dry. There were, however, good paddock feed and winter fodder crops available.

Parts of the western sheep areas experienced drought or near-drought conditions during the winter and spring of 1958, though most had an abundance of good dry feed. Storm rains between October and December improved pastures in most districts, and during 1959 rainfall has been satisfactory in all areas other than the south-west and isolated patches in the central-west and north-west.

The western cattle areas experienced much the same conditions as the sheep areas. Over the remainder of the State conditions in the second half of 1958 were not unfavourable, and in the eastern districts were better than average because of good falls in June. Pasture growth was aided almost everywhere by rains early in 1959, and May falls ensured a good winter in most of the beef cattle areas.

TRADE CONDITIONS

Improved weather conditions throughout the year resulted in an increase in the aggregate volume of production in Australia's rural industries, which has been estimated to be about 11 per cent. higher than ever before.

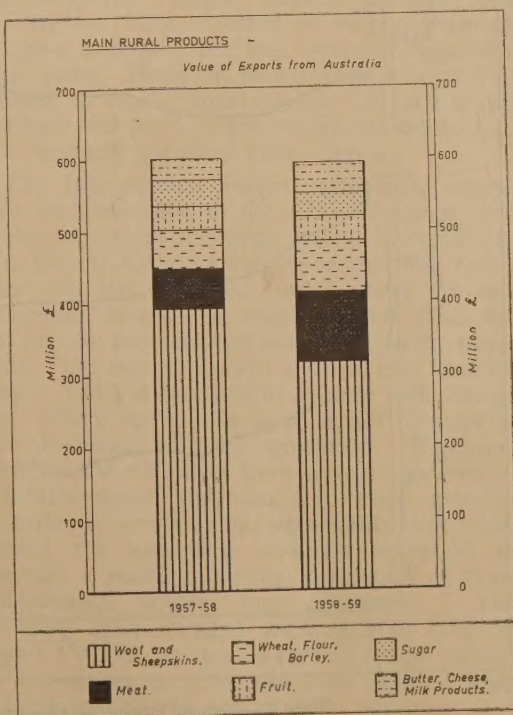


Plate 1.—Value of Exports of Main Rural Products, 1957-58 and 1958-59.

The year's trade results proved to be considerably better than was indicated by the rather bleak outlook at the beginning of the year. Exports at £809m. were only £3m. lower than in 1957-58, and imports were only £3m. higher, giving a trade surplus of £16m., £6m. lower than in the previous year.

Plate 1 shows the variations in the value of exports of certain rural products in 1957-58 and 1958-59.

The value of exports of rural origin was slightly less than in the previous year, and the totals conceal divergent movements in the value of exports of major commodities. Prices of wool and sugar declined, and the market

outlets for canned fruits have been restricted by the heavier European crops and the liberalisation of dollar imports by the United Kingdom. Earnings from exports of meat and of dairy produce have risen following both larger quantities and better prices.

Plate 2 indicates changes in the export prices of sugar, butter, cheese, beef and wool over the last two years.

The adverse effects of lower prices for some commodities, especially wool, have been mitigated by the high capital inflow, which reached £212m. in 1958-59, compared with £134m. in 1957-58.

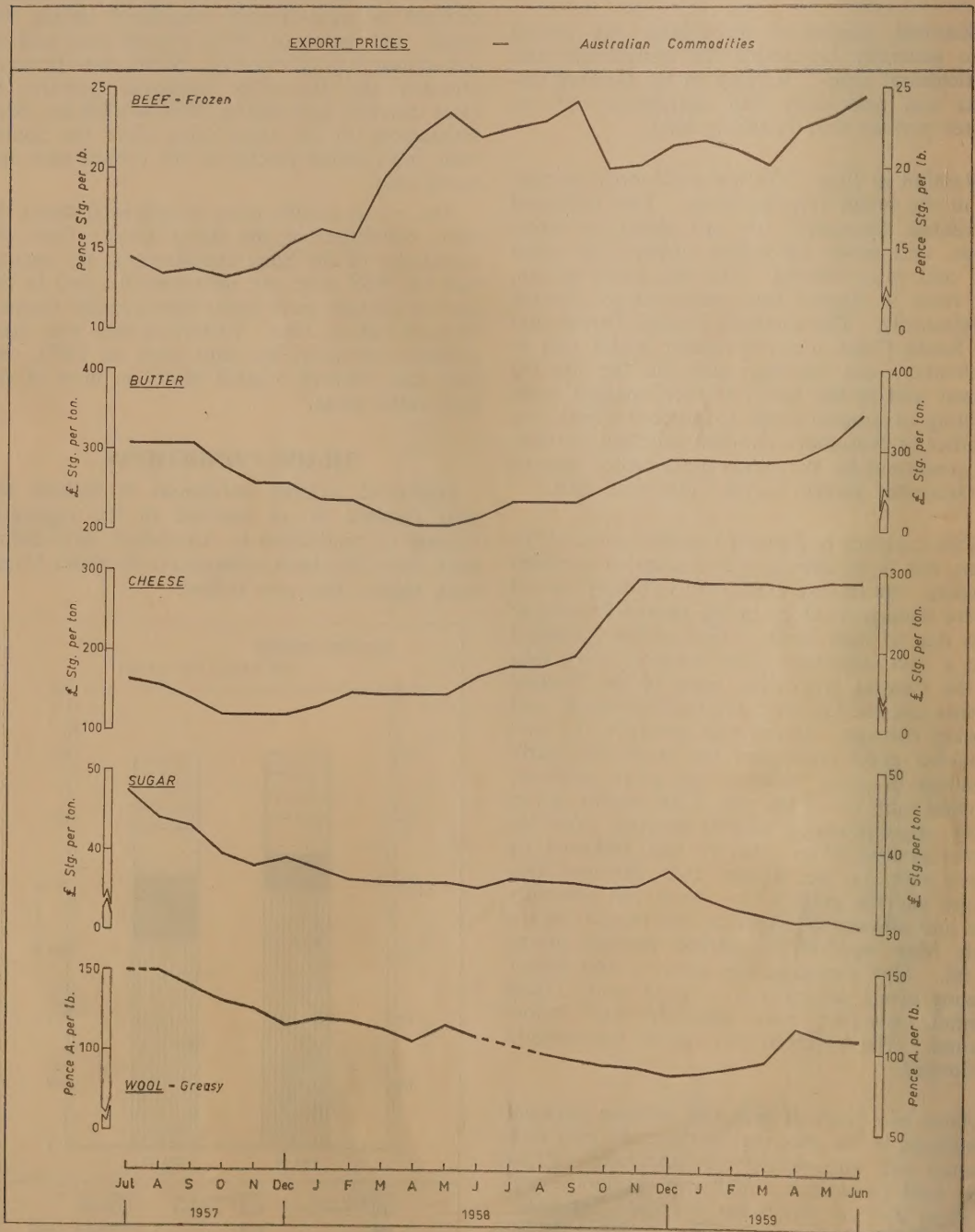


Plate 2.—Export Prices for Important Primary Commodities, 1957-1959.

SUGAR

A new International Sugar Agreement was negotiated at a conference held in October, 1958, to replace the agreement which expired at the end of December. As previously, the agreement will run for five years. This latest agreement will cover a larger proportion of the international trade in sugar, as some important exporters, such as Peru and Brazil, have now joined.

The total export quota of the Commonwealth group of countries will remain at the existing level of 2.5 million tons for 1959, but will be raised to 2.75 million tons in 1960 and 1961. Australia's share will increase from almost 632,000 tons to approximately 650,000 tons.

The past year was the first year in which, because of market limitation, over-production became a problem of some magnitude. It is estimated that a million tons of cane were left unharvested in Queensland, and it is likely that a considerable tonnage will again be unharvested from the current crop. A record 1,412,000 tons of 94 net titre sugar cane were produced in Australia, about 147,000 tons in excess of the aggregate of peaks.

As forecast in last year's report, the average price for the 1958 season, for Home Consumption, Surplus and Excess Sugar, was lower than for the previous year—£46 3s. 2d. per ton, compared with £49 5s. per ton. If Fourth Quota Sugar is included in the 1958 figures, the average price is reduced to £45 6s. 3d. Returns were influenced by the fall in export prices, which continue low, and at the end of June reached the lowest level for the post-war period. Export quotas under the International Sugar Agreement have been reduced by the maximum provided for in the agreement, but Commonwealth countries are not affected by this restriction.

At the annual talks under the Commonwealth Sugar Agreement, the negotiated price for 1959 was fixed at £45 2s. stg. per ton, an increase of £1 5s. 4d. per ton on the 1958 price. As in previous years, the agreement was extended for a further year, and now runs until the end of 1966. The quantity to be sold at the negotiated price was also increased by 2½ per cent., making the quantity in Australia's case 307,500 tons.

Good progress continues to be made with the installation of bulk-loading facilities, and Lucinda and Bundaberg were brought into operation in the past year. Townsville is due for completion in 1959, and Mourilyan is scheduled for operation in 1960.

GRAIN CROPS

Wheat

The acreage planted to wheat during 1958-59 was one of the highest on record, being over 750,000 acres. During the early stages of growth, indications were that the year could well provide a record yield, but the development of stem rust and late-season frosts caused considerable damage to many crops. While the bulk of the planting comprised varieties which had hitherto been resistant to stem-rust, a new strain of rust capable of attacking a number of prominent varieties became dominant during the year. Late-season frosts also caused considerable damage to many crops.

The two varieties Gabo and Charter were most seriously hit by the new stem-rust strain. As both had been very popular varieties for a number of years, their complete loss of resistance to this disease was a serious blow to the industry. Koda and Saga were less prominent varieties which were also attacked by the new rust. Of the well-tried varieties available to Queensland farmers, only Spica and Lawrence (both Queensland-bred) and Festival (bred in New South Wales) retained a satisfactory degree of field resistance. It is on these three varieties, therefore, that the industry must largely depend until newer resistant varieties become generally available.

Three new rust-resistant varieties, Kenora, Hopps and Gala, have been given timely release by the Department. They are at present undergoing increase by the State Wheat Board, and their impact on the industry will not be felt for two or three seasons.

The season saw a record crop in some of the outlying areas such as the Wandoan district. Here yields ranged from 12 to 40 bus. per acre. Gabo was the principal variety grown, and although it suffered rust attack it was seldom seriously affected under these drier conditions.

Indications are that wheat cropping is still expanding in Central Queensland, particularly in the Central Highlands, where about 20,000 acres were planted in 1958.

A steady expansion in bulk-handling of the crop has occurred. During the past year, most major grain growers were equipped for bulk-handling of the harvested crop and the practice is now being adopted on many smaller mixed holdings.

Despite rust and frost damage, the total crop of over 16 m. bus. from a harvested area of about 704,000 acres was the third largest on record. It was more than adequate for domestic needs, providing a surplus of about 6 m. bus. for export and carryover. Export sales to date, of some 2.7 m. bus., have attracted an average premium of more than 10d. per bus. over the Australian f.a.q. price. However, as expected, it is proving difficult to regain flour markets lost during the previous two years, when inadequate wheat supplies severely curtailed flour exports.

The International Wheat Agreement expires with the conclusion of the 1958-59 season, and a new agreement has been written to replace it. The United Kingdom has re-entered the agreement and the quantities traded under the new agreement should be much greater than the 295 m. bus. provided for under the current agreement. The new agreement to come into force on Aug. 1, 1959, is expected to cover at least 420 m. bus. There have been some major changes in the provisions of the agreement. Exporting countries will no longer have separate guaranteed quantities which they can call upon member importing countries to buy at the minimum price. Instead, the importing countries undertake to purchase a stated minimum percentage of their requirements under the agreement. The minimum price remains unchanged at C\$1.50 (about 13s. 6d. per bus. at current freight rates), but the maximum price has been reduced from C\$2.00 to C\$1.90 (about 17s. per bus.).

The coming into operation of a new Wheat Industry Stabilisation Scheme with the 1958-59

season necessitated the repeal of *The Wheat Industry Stabilisation Acts, 1954 to 1957*, and their replacement by new legislation. *The Wheat Industry Stabilisation Act of 1958* was assented to in December 1958 and came into operation on the same day as the complementary Commonwealth legislation. In all essentials the plan provided for is in line with the previous scheme, and will operate for five years. This is the third stabilisation plan implemented by legislation passed by the Commonwealth and the States in the post-war period.

During the year, field work on an economic survey of the wheat industry, which is being made in collaboration with the Council of Agriculture, was completed. This survey is intended to define the economic relationship between the various enterprises conducted on wheat-growing farms.

Barley

One of the outstanding features of the past few crop seasons has been the rapid rise of barley from a minor to a major Queensland crop. During the 1958-59 season its acreage rose to over 248,000, and it is now second in importance to wheat among the State's grain crops, having outstripped the principal summer grains, grain sorghum and maize.

The present industry is based almost exclusively on the one malting barley variety, Prior, which has proved itself hardy, high-yielding and of good malting quality.

The Barley Marketing Board is somewhat concerned over the general high level of protein in this grain, since a high protein content is considered undesirable for malting purposes. On the other hand, a high protein content would enhance the value of the grain for food purposes, whether for human beings or for livestock.

The widespread occurrence of a leaf flecking was reported and steps are being taken to ascertain its cause.

The 1958-59 crop of over 8 m. bus. was nearly double the previous record crop, that of 1955-56; the 1957-58 crop reached almost 3 m. bus. With a plentiful supply of other feed grains—maize, grain sorghum and white French millet—only a relatively small quantity of barley was required for domestic purposes, the bulk being available for export, to which market sales have been made to good advantage by the Barley Marketing Board, some 130,000 tons having already been sold. The remaining small proportion of the crop is expected to be sold in the near future.

Although overseas barley markets have been firm, large world supplies now appear to be assured or in sight for 1959-60, and the market is expected to be more difficult.

Marked improvements have been made in the handling of the crop, with the State Wheat Board handling intake on behalf of the Barley Marketing Board. The Barley Marketing Board realises that there is room for still further improvement in the classification and handling of grain.

Maize

This crop is showing a decided response to the wider use of Queensland certified hybrid maize seed and to improved methods of fallowing and weed control.

The average yield pre-war (1937-38 to 1939-40) was 18.1 bus. per acre, and the averages for 1954-55 (26.9 bus.), 1955-56 (25.1 bus.), 1956-57 (27.6 bus.) and 1957-58 (25.9 bus.) show an improvement of 40 per cent. or more.

Hybrid maize is gaining favour in farming areas in which, since 1939, open-pollinated varieties have progressively lost ground to the grain sorghums. In the Dawson and Callide Valleys, for example, hybrid maize is now regarded as a safe crop on well-fallowed ground. In the Upper Burnett, approximately one acre of maize is now grown to every four acres of grain sorghum, and two-thirds of this maize acreage is planted to hybrids. Modern mechanical picker-threshers are assisting the spread of the crop.

In the Lockyer Valley, early-planted crops were unsuccessful, but later plantings yielded up to 50 bus. per acre. On those farms where maize is regarded solely as a cash crop, over 90 per cent. of the plantings involve Queensland hybrid maize seed. On mixed farms, where the maize may be used for green fodder, silage or grain, over 50 per cent. of the crops grown are from hybrid seed.

The situation in the main maize-growing areas of the Atherton Tableland is far from satisfactory. This area has for many years been one of declining maize yields, due very largely to the agricultural system, which relies almost entirely on maize monoculture. Crops looked well during the early portion of the current season, but a combination of excessive late rain, cob-rots, corn ear-worm and a virulent rust attack has greatly reduced crop prospects.

In this area the available Australian hybrids give variable performances, depending largely on the extent of cob-rot attack. The development of a suitable hybrid for the area is a current project of the Queensland Agricultural College and this Department. If this project is successful, some alleviation of the situation could be expected. However, the main problem in this district is related to land use and cannot be simply solved by providing better adapted varieties or hybrids.

The 1959 maize crop is expected to be about 20 per cent. above the previous crop of 2.5 m. bus. and, as in the case of other feed grains, local market prices have weakened.

Grain Sorghum

Sorghum midge activity in most sorghum growing districts was sufficient to cause severe losses in some crops. Reports of successful control of midge by aerial spraying have been received from the Darling Downs. This is contrary to previous experience with this means of control.

With the exception of the Darling Downs, where Early Kalo has emerged as the leading variety, Alpha continues as the major variety grown in the sorghum-producing areas. Yields as high as 126 bus. per acre have been reported where good dry-farming practice has been adopted on fertile soils.

Experience has demonstrated that this crop can be grown on forest country on the Atherton Tableland, but present low prices, coupled with the scarcity of suitable harvesters, will probably restrict its production in this area.

Certified seed production of major varieties continues to raise the general standard of crops produced. The Department's hybrid sorghum breeding programme is still in its initial stages, but may be expected to have an important impact upon the industry during the next decade.

The grain sorghum harvest is expected to yield about 3·8 m. bus., compared with 3 m. bus. last year, and the Grain Sorghum Marketing Board has already received a fair proportion of the crop. With plentiful supplies of feed grains available, a large surplus exists for export. No difficulty is expected in clearing the crop, although the market has weakened, following early prices which were higher than had been expected.

TOBACCO

The tobacco acreage in Queensland for 1958-59 has shown an increase on the previous year of approximately 800 acres, reaching a figure of nearly 8,600 acres. Further increases are confidently expected in the coming year, mainly in the Bundaberg district and the far northern areas around Mareeba and Dimbulah.

Interest has been stimulated around Bundaberg by the excellent yields and quality of leaf produced. In the North, further development of the Mareeba-Dimbulah Irrigation Project has resulted in the opening up of new farms. This development will also ensure better production from recognised tobacco areas where crops have previously been grown under rainfall alone.

The season was marked by dry conditions during 1958 and often extremely wet conditions during the 1959 period. The dry growing season for the North Queensland crops was reflected in periodic shortages of irrigation water and a low incidence of blue mould except in the late crops. Leaf miner, however, was particularly troublesome, and control methods used were not always effective.

The southern Queensland crops, planted from October onwards, suffered very heavily from blue mould, which was favoured by showery and overcast conditions in January. Some growers lost up to half their crop.

February was marked by a severe cyclonic depression which caused considerable damage to late crops and stored tobacco on the Lower Burdekin, and to the growing crop in the border districts of Inglewood, Texas and Yelarbon.

From a production point of view, however, the year has generally been a successful one. Over 2,000 tons from 4,600 acres were offered at the Mareeba sales, with practically a total clearance for an average of 135·4d. per lb. This compares reasonably well with 138·58d. per lb. in the previous season.

Yields from the Lower Burdekin were an improvement on those of the previous season (1,100 lb. per acre, compared with 786 lb. per acre). The average price has fallen, however, and there is clearly some buyer resistance to leaf from this area. The question of quality in relation to soil type and other factors is an important matter for current investigation.

While the yield from South Queensland border districts was seriously reduced by weather hazards, the leaf is of much better quality than in

the previous year and good auctions have resulted. Both yield and quality have been most promising in the Bundaberg district and a big expansion is anticipated there.

The efficiency of tobacco growers continues to improve as a result of the efforts of field officers associated with various sections of the industry. For example, an estimated 80-85 per cent. of tobacco growers throughout the State are now using fumigation in the field for nematode control. Fertilizers in use vary greatly in composition, with a continued trend towards increased use of potash to offset high chlorine levels and improve leaf quality.

The varietal position has remained static, with 70 per cent. of the State acreage being planted to Hicks and 25 per cent. to Virginia Gold. Virginia Bright Leaf, Gold Dollar and 402 are the other varieties in limited demand, but several promising new varieties are now being tested on the Tobacco Experiment Stations.

Development of the Tobacco Experiment Stations at Parada and Inglewood has been continued with funds from the Tobacco Industry Trust Account and from State sources. A machinery shed and quarters for technical staff have been completed at Parada, and further building expansion is planned. At this Station investigations are under way on the agronomic potentials of five different soil types and the control of tobacco pests and diseases, while the testing of promising varieties has continued. This season two of the varieties, Mammoth Delcrest and Special Virginia, yielded more than 2,000 lb. of graded leaf per acre.

Plans have been drawn up for an office-laboratory block at the Inglewood Station, where investigations will continue on crop rotations, varietal testing, blue mould control and chlorine uptake problems.

Against the background of inadequate export earnings and balance of payments problems, the continued development of the tobacco growing industry presents a picture of relief. Between 1939 and 1959 Australian consumption of tobacco products increased from about 36 m. lb. to approximately 50 m. lb. But for the expansion of the local industry the whole of this increase would have had to be met by imports. The savings in overseas funds resulting from this increased production have been about £3 m. per year, a substantial saving of foreign exchange.

During the last 10 years, Australian tobacco leaf production has risen from 3·4 m. lb. to 14·8 m. lb., and, although all tobacco growing States have contributed to the increase, Queensland alone has accounted for half this total. This State's production has increased from 1·6 m. lb. in 1948-49 to about 7·2 m. lb. this year.

This increase in domestic production has had a marked effect on the composition of tobacco products manufactured and consumed in Australia. The minimum percentages of Australian leaf which manufacturers are required to incorporate in their products, in order to qualify for reduced tariffs on imported tobacco, have been progressively increased, and as from July 1, 1960, these percentages will be 28½ per cent. for cigarettes and 24½ per cent. for tobacco. These percentages are announced well in advance,

to allow for maturation of the necessary leaf. Ten years ago the minimum percentages were only 3 per cent. for cigarettes and 5 per cent. for tobacco.

The sale of tobacco leaf still demands a great deal of attention, and although there has been much negotiation between the Tobacco Leaf Marketing Board and tobacco manufacturers, a price stabilisation scheme has yet to be achieved. The results of sales still depend upon the extent of competition and the operation of the blending percentage system with related tariffs.

Selling of the 1959 crop in North Queensland has been completed, as have the first series of South Queensland sales. Some 5,573,416 lb. of leaf were sold in North Queensland at an average price of 129·92d. per lb. South Queensland sales to date have averaged 140·3d. per lb. Average prices for the previous crop were 135·71d. per lb. for North Queensland and 123·53d. per lb. for South Queensland.

COTTON

The lack of early planting rains delayed most non-irrigated plantings until December, though some scattered areas managed a more seasonable October planting.

Plantings in 1958 amounted to 17,700 acres, which produced just over 3,000 bales, from a harvested acreage of 9,550 acres. Most districts in which the cotton crop has some potential report an increasing interest in its production. This interest has arisen primarily from continuing unsatisfactory prices for summer grain crops, but the introduction of new ideas on cotton production and its further demonstration as a suitable irrigation crop have helped considerably. The recognition of the possibilities on soils of normal or high fertility, coupled with a sound cultural and insect control programme, may see the crop widely extended. There is a growing realisation amongst farmers and others associated with agricultural industry that Queensland can not afford to neglect this import-saving crop.

A major development during the past year was the establishment of a demonstration and experimental plot of 48 acres in the St. George irrigation area, in which the Cotton Marketing Board is co-operating with the Irrigation and Water Supply Commission and this Department. The Board provides seed and labour, the irrigation authorities all the machinery, and this Department the advisory services. Arrangements have been made with the Commonwealth Government to include in bounty calculations any profits or losses on this venture.

Farmers in the St. George area are showing increasing interest in cotton growing, and it is expected that plantings in the area for the 1959 season will reach nearly 1,000 acres. Results from earlier plantings had been good, and the best-yielding crop had given a very good yield, for a first essay at growing this crop, of 1,300 lb. of seed cotton per acre.

Nitrogenous fertilizers appear to be economically sound under irrigation, though further trials are necessary to determine rates, methods and perhaps times of application. Yields of up to

3,000 lb. of seed cotton per acre have been obtained under irrigation at Inglewood. Indications are that planting rates need to be increased, particularly on heavy soils.

The future development of the industry is closely tied to mechanical harvesting of the crop and therefore varieties and cultural techniques appropriate to this process are urgently needed.

Experimental plantings have been made in Victoria and New South Wales, and the Queensland Cotton Marketing Board, which has the only cotton ginnery in Australia, has made arrangements to gin the cotton on behalf of the growers concerned.

In view of the increased amount of machine-picked cotton which is resulting from expansion of the industry, the Board has under consideration the installation of improved machinery in the ginneries, with the object of ensuring the highest practicable outturn of high-grade cotton lint.

PEANUTS

Growing and harvesting conditions were favourable for the 1958 crop, and the Peanut Marketing Board's receipts totalled over 18,000 tons, more than twice the crop of the previous year. The final payment was made to growers on the 1957 crop, bringing the average net return to growers to 12·385d. per lb., the highest return yet received.

Increased interest continues to be shown in peanut growing, and the acreage sown in 1958 was almost doubled in 1959 to an estimated 60,000 acres. The crop is expected to reach 34,000 tons.

The Board is thus faced with the problem of disposing of its largest crop on record, and it has taken steps to promote the increased consumption of peanuts in Australia. Exports are more or less precluded because of the price factor. An advertising campaign, in conjunction with a recipe competition, has been successfully organised through a national women's journal, and the Board has also reduced the price of peanuts-in-shell, in an effort to increase sales. Negotiations are pending for a national survey of the market potential in Australia, and further sales promotion is proposed. There appears to be a gradual increase in consumption, more particularly of peanut oil.

The Tariff Board Report on peanuts, peanut kernels and peanut oil was published in 1958. Although further protection was granted the industry by increases in tariff on all three categories, the beneficial effects were largely vitiated by the removal of primage duties.

The early-planted crops, established after the October rains, gave highest yields in the range 1,200-1,700 lb. to the acre, while the later planted crops (December-early January) are expected to yield up to 1,200 lb. per acre. The planted area in the South Burnett was approximately double last year's area of 20,000 acres.

In the Callide, yields were in the vicinity of 1,200 lb. per acre, with Red Spanish giving best results under the somewhat dry climatic conditions. In the Upper Burnett yields were slightly higher (1,500 lb. per acre).

On the Atherton Tableland, some 7,400 acres were planted, mainly in December. Heavy rain and overcast conditions in February and March encouraged leaf spot, which in turn hastened maturity. The wet soil conditions also interfered with cultivation and weed control. The earlier maturing Red Spanish crops were ready for harvesting in April and eight peanut driers prepared these crops for marketing. The later Virginia Bunch crops matured under cloudy, rainy conditions and yields and quality were reduced. The average yield was about 900 lb. to the acre.

In the South Burnett, about 40 per cent. of the acreage was sun-dried. This method of harvesting has not increased at the rate previously anticipated, although pick-up threshers are still being manufactured and purchased. The main difficulty lies in the reduction in quality resulting from sun-drying; the too rapid drying under the favourable harvesting conditions this season caused the seed coat to crack and loosen.

The windrowing of four peanut rows together has not satisfactorily overcome this quality problem, as the side-delivery rakes used leave many peanuts directly exposed to the sun. The appearance of the nuts too has been spoilt by soil stains resulting from the pulled peanuts sinking back into the loose red soil following rain.

The Victory peanut stooker does a very satisfactory and rapid job of stooking peanuts, thus eliminating hand labour from this stage in the old orthodox curing process. It is now hydraulically operated and the price is in the vicinity of £900. The cost may well deter the smaller farmer from acquiring this type of machine.

It is difficult to forecast likely trends. Over half the crop this year was stooked but harvesting conditions could produce a swing to sun-drying, because of the possibility of getting the peanuts off the land more quickly.

The Department of Primary Industry, in co-operation with the Peanut Marketing Board and this Department, continued to investigate techniques of artificial drying of peanuts. Proposals are also in hand to examine rack drying of peanuts in special loose-weave bags.

LINSEED

A great reduction in acreage planted to this crop on the Darling Downs followed severe *Heliothis* attack and plant nutritional trouble in the 1957-58 season. This reduction was particularly noticeable on the open plains soils. In the 1958-59 season two-thirds of the planted acreage was on brigalow and marginal soils. A summary of the situation on the Darling Downs is as follows:—open downs areas, 10,142 acres, 92 growers; brigalow and marginal areas, 22,839 acres, 285 growers.

Both of the troubles encountered so severely in the previous season were less evident in 1958-59, and average yields of 4.8 cwt. per acre were obtained from the total area planted. This contrasts with the yield of 1.3 cwt. per acre from the 1957-58 crop.

Concern over the nutritional deficiency trouble on open downs soils is widespread. but despite this it is anticipated that plantings will increase in 1959-60.

Interest in this crop in the Dawson-Callide has been lost following two years of severe *Heliothis* attack.

Plantings in the Central Highlands were reduced considerably for 1959-60 by the lack of rains in April. Nevertheless, 7,000 acres have been planted. This represents a considerable expansion on the previous season's planting of 1,500 acres.

FRUIT AND VEGETABLES

Marketing

A committee comprising representatives of various interests, under the Chairmanship of the Co-ordinator-General of Public Works (Mr. J. Holt) was established to investigate all aspects of municipal marketing of fruit and vegetables in Brisbane. The Director of Marketing was a member of the committee. Particular attention was paid to the economics of municipal marketing, the type of control desirable in the establishment of municipal markets, the operation of such markets after establishment, and the most suitable site for the location of such markets in the metropolitan area. The committee's report was finalised in February.

A Bill to amend the Fruit and Vegetables Act was passed by Parliament in March. The amendments were designed to meet recent changes in marketing procedure, to correct several deficiencies in the existing Act and to define clearly the actions which may be taken under this legislation to control the quality of fruit and vegetables offered for sale. In addition, *The Fruit and Vegetables Grading and Packing Regulations of 1953* were amended in relation to apples, apricots, peaches and tomatoes.

Although the standard of market presentation of fruit and vegetables has improved over the years through more careful handling and better grading, the services of three specialist officers are fully occupied in giving instruction to individual growers and training school children.

The trend is towards mechanical handling and the carriage of fruit in bulk from the grower direct to the self-service store in order to reduce post-harvesting costs.

There are insufficient data on post-harvest physiology and much should be learnt when the Hamilton laboratory is functioning. Wrapping of fruits and vegetables in plastic materials has become a feature of supermarkets, but the effects are not always beneficial. Fundamental work on the permeability of plastics to water vapour and respiratory gases needs to be done over a wide range of storage conditions before commercial application can be recommended.

Transport

The major technical problems in refrigerated transport in Queensland have been overcome, and a self-cooling wagon designed by Departmental officers has been completely successful in carrying fruits and vegetables over long distances in Queensland. While the transport period has been reduced by the diesel engine, the same applies in other States. It is anomalous that the majority of consignments entering Queensland are carried by refrigerated transport but recon-

signed to much warmer destinations in Queensland in unrefrigerated wagons. It is difficult to know how the problem can be overcome, unless country consumers are prepared to pay a premium for better quality. Road transport, which enables consignments to be taken direct from the orchard or packing shed to the market, will play an increasingly important part in the marketing of produce from the Stanthorpe, Metropolitan and Near North Coast districts. If freight rates could be made competitive with rail, air transport could become the major mode of distribution in Queensland.

Crop Utilization

In the past, horticultural development in Queensland has been dependent largely on the fresh fruit and vegetable markets. Although consumption levels of fresh fruit and vegetables are determined by quality and price, there is a limit to which consumption can be increased in Australia. As an aftermath of World War II., when processed foods were manufactured for the services, there has been a marked change in our food habits and the consumer now demands foods of convenience. Processing of fruits in Queensland has made rapid progress in recent years and the major portion of the pineapple, papaw and strawberry crops is now canned. There will be a surplus of over 20,000 tons of canned pineapple from the 1959 crop in excess of Australian requirements, and marketing conditions overseas are far from satisfactory. The question whether canned fruit salad and fruit cocktail, which contain about 60 per cent. of pineapple, have a greater sales appeal than canned pineapple should be carefully considered. Some Queensland processors are now packing fruit salad in preference to pineapple and there is a keen demand for papaws, the other main ingredient of fruit salad. Much greater attention will have to be given to crop utilization in Queensland and a wider range of products will have to be developed for the major fruits and vegetables. In vegetables we lag behind other States in quick freezing, dehydrated and concentrated vegetable soups, which are becoming increasingly popular in the retail stores and the sales of which must be affecting the marketing of fresh vegetables.

In other fields, potato products are becoming important and consideration will soon have to be given to the production of potato flour or potato flakes which can be quickly converted to an attractive mashed product by the addition of hot water and a little milk.

Pineapples

Pineapple production from the 1958 winter crop was the highest on record for a winter crop, and this was followed by particularly heavy production from the summer crop, due mainly to mild temperatures and well-distributed rainfall during the spring and summer. Receipts of 39,619 tons by C.O.D. canneries from the 1959 summer crop were an increase of 83 per cent. on the previous year and 37 per cent. on the previous record year, 1955. Total production for 1958-59 was a record 3,700,000 cases, of which about 70 per cent. was processed. The area under crop reached a peak of 14,000 acres.

Heavy plantings in 1957 and 1958, together with the general adoption of close spacing in the row and the use of high-potassium fertilizers recently recommended by the Department, are contributory factors to high yields.

The continued increase in production in Queensland, together with continued severe competition on overseas markets, has led to difficulties in the industry. The incidence of heavy crops and the smaller and slower sales of processed pineapples have resulted in heavier demands on available finance. To help tide the C.O.D. cannery over this period, the Government has guaranteed a bank overdraft of £2.4 million.

The Pineapple Sectional Group Committee reduced the price for pineapples for May-June deliveries to £15 per ton, delivered Brisbane, for 1st grade, compared with from £22 10s. 0d. per ton for the summer crop; third grade fruit was not accepted for canning.

A ballot held by the C.O.D. on the question whether the Northgate and Koongal canneries should be operated within or without the framework of that organisation was decided in the affirmative.

The Pineapple Advisory Committee has been occupied with production problems. Discussions have emphasised the fact that a more detailed knowledge of environmental effects on plant growth is a prerequisite to any major development in production techniques. The decision of the Pineapple Sectional Group Committee to finance the establishment of a pineapple plant physiology unit within the Horticulture Branch should make possible some much-needed fundamental investigations on this subject.

Bananas

During the 1955-1957 period, the Australian markets were frequently under-supplied with bananas due to the effect of cyclones and dry weather on production. Since 1957, growing conditions have been uniformly good in most parts of the State, fruit quality was excellent, fruit size well above average and supplies well in excess of normal demands. Production in 1958-59 came from a total area of 12,325 acres.

The area now under crop shows a slight rise over that of the previous year. However, the sharp fluctuations in planting which were characteristic of the 1930's are no longer a disrupting feature of the industry, as a large proportion of the crop is now produced by growers with a permanent stake in the industry.

North Queensland plays an increasingly important part in supplying the market for winter fruit in southern capitals. Improved transport facilities are partly responsible for this trend, but perhaps more significant is better plantation management in that area with the primary aim of producing the bulk of the crop in the winter months. Even the best available winter fruit grown in southern Queensland and northern New South Wales is much inferior to that consigned from North Queensland between June and September.

The trend for the Mons Mari variety to replace the Cavendish continues. This reflects the greater tolerance of the former variety to stress conditions

insofar as these affect the incidence of choke-throat and fruit quality. Lady Finger still maintains an important place in the industry; were it not for the hazard created by Panama disease, production of this variety would certainly expand.

Spike-leaf—an abnormal type of leaf with a reduced lamina—caused some concern in the Caboolture district. It is apparently an aftermath of chilling at the growing point during the winter months and thus bears some resemblance to the “November dump” bunch phenomenon. Another abnormality is reported from the Innisfail district, where the leaves in the middle region of the crown sometimes collapse prematurely and affect subsequent bunch size and development. The symptoms suggest nutrient imbalance.

Banana growers are very disease-conscious. Control of leaf spot, for example, is achieved with full-volume copper-oil sprays in North Queensland. The equipment used, however, could hardly be used in hillside plantations in the south, and the alternative—misting and fogging equipment—though of doubtful value, attracts considerable attention from growers.

Citrus

Citrus growers had a fair year. Production from irrigated orchards was a shade above normal but non-irrigated coastal orchards carry only a light crop of rather large fruit. Production estimated at 600,000 bus. from a bearing area of 4,200 acres will more than meet market requirements.

Emperor mandarin production, which some years ago was threatened with partial extinction in the Burrum district owing to recurrent losses from brown spot, has revived. This is almost certainly due to more efficient orchard management and particularly the use of copper-zinc sprays and the establishment of sod in orchards where irrigation facilities are available. Loss of crop from brown spot was negligible during the year.

The area under oranges remains steady but the crop is meeting increased competition from fruit grown in southern States. Our only advantage in the Australian market for Queensland oranges is earliness of maturity; Queensland crops are ready for harvest some three weeks ahead of those in the south. Coastal oranges suffer severely from southern competition and future expansion in this area will therefore depend mainly on expanded outlets for the juice.

Trouble was again encountered with early consignments of fruit, which, though complying with maturity standards, were far from palatable. The relatively low returns for Washington Navel oranges were probably a sequel to adverse consumer reaction to immature fruit placed on the market at the commencement of the season.

The area under Meyer lemons continues to expand. Though it is a lemon x orange hybrid, fruit picked in the mature-green stage and artificially coloured sells extremely well. In addition, the tree thrives in some soil types which are not normally considered suitable for commercial lemon production.

Papaws

The main producing areas are Sunnybank, Brookfield and Yarwun. Crops were generally very heavy, with a full set of moderately sized

fruit of better-than-average quality. Production is about 420,000 cases and the area under crop about 900 acres. Approximately 30 per cent. of the crop was handled by canneries.

Growers are concerned with varietal improvement and disease control. There is still excessive variability in the plant type and fruit type in most plantations and it is therefore rather surprising that the demand for Hybrid No. 5 seed has not been greater. The high price of the seed is perhaps a deterrent to its wider use.

The practice of planting at intervals of 3 ft. and subsequently thinning out the stand to the usual 8 ft. when the sex characteristics of the plant become apparent is gaining ground. It has the merit of reducing inter-plant competition in the early stages of growth and, possibly, reducing the overall plant height in the plantation. Lopping healthy trees at the end of the season's crop is also on the increase; it minimises the problem of harvesting from tall trees in the second and third crops.

In spite of the almost insuperable difficulties involved in producing a variety suitable for both the fresh fruit and factory trades, growers still consider such a variety essential. Dual outlets for the fruit, though doubtless a safeguard against major upsets in marketing, are frequently a barrier to efficient plantation management.

Production at Mackay, formerly an expanding papaw area, is now negligible following cyclonic rains in 1957-58 and widespread plant losses from *Phytophthora* root-rots. This disease has been reported from southern Queensland but not in destructive outbreaks.

Apples

Apple growers at Stanthorpe had a mixed year. The initial fruit set was better than anticipated following the relatively dry 1957-58, and the spring flush of growth was satisfactory. Early-maturing varieties sized rapidly and were marketed in excellent order. However, late varieties such as Granny Smith and Delicious, which provide the greater part of the farm income, suffered severe damage from hail in March, when the crop is normally considered safe from this hazard. Much of the fruit placed on the market showed superficial hail blemish. Production amounted to 800,000 bus. from some 6,000 acres in bearing.

Early shipments by fast passenger liners to the United Kingdom made prices comparable with the good prices obtained last year, but later shipments did not meet such a good market and brought up to 10s. less per case.

Plantings were again heavy and showed considerable grower interest in the variety Delicious. The Broadwater Nursery operated by the Deciduous Fruits Sectional Group Committee supplied about 40 per cent. of the trees planted. The quality of those on Merton 799 and Merton 793 is satisfactory at present, but methods of land management need overhauling if tree vigour is to be maintained at an optimum level in the future.

Both trials and grower experience suggest that some of the poor results reported with replant orchards were due to inadequate fertilizer programmes during the early life of the tree and/or

lack of sufficient depth of soil at the time of planting. The better growers now plant on contoured mounds, which increase the depth of soil in the immediate vicinity of the trunk, and also apply complete fertilizers from the time of planting.

Salting troubles are very pronounced in some parts of the district, notably Glen Niven, where impeded drainage and local high water-tables are characteristic features. Capital expenditure on sub-surface drains would be a worthwhile investment in the orchards concerned.

Bulk harvesting has been adopted by several large apple growers in the Granite Belt and should reduce harvesting costs considerably. The methods used vary, but experience should lead to standardised procedures, which are essential for the efficient use of such techniques.

Grapes

Grape growers had a relatively poor year.

In coastal areas, the vines bore heavily but berry flavour was indifferent and the skin lacked colour. Nevertheless, the area under grapes on the lighter soil types between Brisbane and Ipswich is increasing.

At Coominya and Roma, bunch development was satisfactory but diseases such as anthracnose and powdery mildew were difficult to control. Wastage was high and a considerable amount of bunch trimming was necessary at harvesting.

At Stanthorpe, severe hail followed by heavy rains in March caused a great deal of damage to both fruit and canes and the harvested crop was well below normal. Coming after the drought in 1957-58, this result was disappointing. The practice of propagating Waltham Cross and Purple Cornichon grapes on *Phylloxera*-resistant stocks is popular. Both are inherently weak vines on their own roots and the vigour conferred on them by stocks such as *Rupestris* du Lot and 3309 is an advantage in the relatively infertile soils of the Stanthorpe district.

Potatoes

Potato crops suffered from weather damage in many districts.

Both the Lockyer Valley and Boonah districts reported frost damage in the spring crop. Prices, except for early crop (£60 per ton), were unsatisfactory, the average for the spring crop being only £25 per ton. The autumn crop was severely affected by floods in February and crops were reduced by about one-third. Prices again were low, £20-£25 per ton.

The excessive tuber size of current varieties of potatoes is causing concern and changes in growing procedures appear inevitable.

Reports from North Queensland suggest that despite the high costs of production and restricted markets available, local crops are proving profitable. Expansion could occur here provided an appropriate regimen of fertilizing, watering and pest control is adhered to. Average yields from this area were 9-10 tons per acre, and one 8-acre area at Kaban (Evelyn Tableland) yielded 23 tons per acre.

The need for improving standards of presentation for market is very evident and is the subject of an extension drive in southern Queensland.

Onions

The 1958 crop was of poor quality, and the unseasonably warm weather in early winter resulted in rapid maturity and low yields; small-sized onions averaged less than 2 in. diameter. This warm weather also led to an increase in pink root disease. In addition, prices were low, varying from £18 to £25 per ton.

Plantings in 1959 were delayed by February floods, but the total area planted in this season was above average.

As in potatoes and pumpkins, standards of presentation for market leave much to be desired, and growers are being urged to give serious attention to this matter.

Tomatoes

Tomato growers, on the whole, had an indifferent year. Production was high in coastal Queensland during the autumn, winter and spring months and even good quality fruit sold very cheaply. The summer crop at Stanthorpe showed promise early in the season but collapsed quickly following heavy rains in March, when conditions were favourable for the spread of disease. Production is estimated at 1,300,000 half-bushel cases from an area of 5,500 acres.

About half of the crop is grown from certified seed (Q2, Q3 and Q5) produced at Stanthorpe. Q2 is the principal variety grown in southern coastal Queensland and Stanthorpe, while Q3 dominates mid-season and late-season production in both the dry tropics and the wet tropics. The place of Q5, recently released, has yet to be determined; demand is fair and comes from a variety of sources. It may increase when growers become familiar with the peculiarities of the variety and learn how to grow it. The strong demand from Bowen for Stanthorpe-grown Q3 seed is noteworthy, as Bowen growers traditionally reserve their own seed for future use.

The parallel-wire trellis adopted at Redlands some years ago and now in general use in that district has found adherents elsewhere in southern Queensland. It has proved less satisfactory both in central Queensland and in the far North, where the plants are generally more vigorous. In these areas, the trellis tends to become over-crowded and harvesting difficulties are accentuated. At Bowen, trellising appears to have little future. Production in this area is carried out on an extensive, low-cost scale on the assumption that price levels for fruit placed on southern markets will only be payable for short periods. Trellising is essentially a high-cost method of production of fruit for specific markets and loses much of its value where the speculative element enters into production planning.

In the Redlands district, winter production of tomatoes is becoming increasingly difficult owing to the incidence of leaf shrivel virus. The cluster types formerly grown for this crop are gradually being discarded. Attempts are frequently made to prolong the cropping life of autumn-planted globe varieties but this is not entirely satisfactory.

The shortage of locally grown winter tomatoes explains the large quantities of Bowen fruit now supplied to the Brisbane market.

Beans

Heavy supplies of beans were available during the greater part of the year and production reached the record figure of 660,000 bus. from 5,800 acres.

The monthly price pattern showed the influence of developments in green bean production in the Lower Burdekin. Heavy consignments from this area made an appreciable impact on the normal high prices of the July-August market. It would appear that winter green bean production will become a permanent feature in the dry tropics and have considerable repercussions on the industry in southern Queensland.

The new varieties—Redlands Belle and Redlands Beauty—were released to growers for observation plantings. Growers were more or less equally divided in their ratings. A check of the questionnaire circulated to growers by the Committee of Direction of Fruit Marketing suggests that the performance of both is markedly influenced by soil and climatic factors during the growing period.

Adequate supplies of seed with the required specifications for type and freedom from disease were available to the green bean industry. This was in part due to expanded production on the Burdekin. The limited avenues for disposal of surplus stocks may involve distributors in financial loss.

WOOL INDUSTRY

A year of depressed wool prices, with one encouraging lift that failed to maintain itself, has been a cause of considerable anxiety to wool-growers and manufacturers, and has presented a formidable threat to Australia's economy generally. However, reduction of wool prices has, in the main, brought raw wools below the cost of raw synthetic apparel fibres, enabling more favourable competition with these.

The sale of 725,198 bales of Queensland wool realised £47·28 m. The amount of wool sold shows an increase in quantity of 2·8 per cent. on the previous year's total, but the financial return because of the year's low wool prices was down £10·1 m. Drought conditions took toll of flocks in south-western Queensland, and in many cases have prevented normal matings for natural increase for a 2-year period in such areas. In spite of this, the year's wool clip maintained a high level, with the last Brisbane sales in June offering 97,000 bales, approaching the quantity of two normal sales in one.

Normal Queensland wool auctions annually comprise a series of 11 Brisbane auction sales spread over nine months of the year. The August 1958 sale commenced the selling season with a drop of 4d. per lb. on the last sale of the previous year, with an average of 49·51d. For two further sales prices remained almost static. In the next four sales from October to March, prices ebbed further, with a minimum of 45·16d. per lb. in December. The April 1959 sale showed a marked and welcome rise of 24 per cent. on the previous

month to 56·96d. Values, however, had again dropped almost 10 per cent. by May, and in the final sale of the year, with its unusually large offering, the average price was 51·38d. On these levels the season concluded with a keen demand and on a fairly firm note.

The generally depressed state of the wool market throughout the year stimulated enquiry by growers and manufacturers into a review of marketing methods, and initiated a considerable drive by industry representatives to step up the advertising of fabrics and clothing derived from wool, and to seek further avenues for the sale of raw wool and finished wool products, in both the domestic and the international spheres.

The period of depressed wool prices had a dual effect on pasture improvement activities in the wool-producing areas. One was a fall in the rate of land clearing. For example, in the gidgee country, scrub pulling in preparation for pasture establishment was greatly reduced. The other result was to stimulate interest in the search for increased efficiency of production. Pasture improvement was recognised as one means of achieving this increase.

Sown pastures of buffel grass, green panic, lucerne and medics in the Tara-Glenmorgan district, buffel grass in the Dirranbandi area, winter pastures on the granite country near Stanthorpe, and lucerne on the traprock soils of the Warwick-Texas region are examples of this significant trend.

The capacity of buffel grass to withstand severe drought and heavy grazing without significant loss of stand has stimulated interest in this grass in those sheep districts of the west where Mitchell, Flinders and blue grasses do not occur. Increasing numbers of small trial plantings are being made by graziers.

Drought conditions have also stimulated interest in irrigation. One grazier in south-western Queensland is preparing a water storage structure to hold 170,000,000 gallons for irrigating lucerne and other fodder crops.

BEEF INDUSTRY

Production of beef in Australia in 1958-59 is estimated at a record 875,000 tons, and exports at 175,000 tons. Production in Queensland in the 12 months ended June 30, 1959, was a record and 22 per cent. higher than in the previous year.

The 15-year Meat Agreement with the United Kingdom was last reviewed in September 1958, when new minima prices were negotiated. The new minima for beef and veal for 1961-1964 are 9 per cent. less than the 1958-1961 level, minimum prices for mutton for 1958-1960 are the 1958-1961 level less 15 per cent., and lamb prices for 1958-1960 show a reduction of 5 per cent. on 1955-1958. A welcome amendment is that the beef export free quota for the three years 1958-1961 will be a maximum of 7,500 tons per year of first and second quality beef, with no quantitative restrictions on the export of lower grades, and it may be noted that actual prices received have been appreciably above the agreed minimum.

This easing of exports of lower grades of beef has resulted in the sudden large expansion of beef exports to the United States, encouraged by the upsurge in the United States demand for these lower grades which are suitable for the manufacturing trades. Beef exports to the United States trebled in 1957-58 to 6,134 tons, but in 1958-59 are expected to total about 30,000-40,000 tons.

Plate 3 shows the distribution of beef exports from Australia in the last two years.

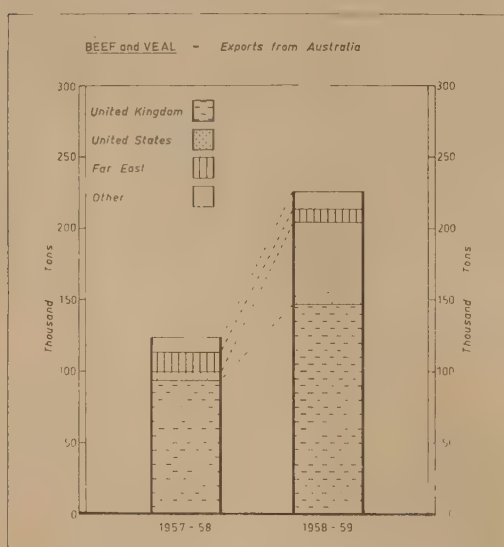


Plate 3.—Quantities of Beef and Veal Exported from Australia, 1957-58 and 1958-59.

Another favourable influence on the beef export trade has been the continued high prices in the United Kingdom during the last 12 months. Owing in part to the decline of Argentine shipments they have been on average about one-third higher than in the preceding year, as will be seen from Plate 2.

The increased demand for lower grade meat has affected cattle prices in Australia. Cull cows and bulls have brought prices better than those realised for first-quality beasts 12 months earlier. This should make possible younger and higher quality herds in both beef and dairy industries. Prices have risen sharply for the local canning industry, which is already facing severe competition in export markets, and prices of better quality beef to the domestic consumer have also risen.

It appears, however, that the major future outlet for Australian beef will be the home market, where over 80 per cent. of production is consumed, followed by the United Kingdom, where the 15-year Meat Agreement provides a guaranteed minimum price until 1967. The United States, at present, probably offers the best scope among other markets.

It had been felt that the high prices offered for cow beef for the United States trade might induce graziers to sell breeders in a short-sighted policy of obtaining quick returns. However, there has been little change in the proportion of cows to bullocks slaughtered, in spite of the much

higher turnover. It is generally considered the American market has offered a lucrative market for many cattle which, in view of the dry season experienced throughout much of the beef-raising area, would have been difficult to dispose of locally. The number of females slaughtered has been appreciably augmented by the inclusion of old beef breeders which previously would have been allowed to die of old age. Such additions to the slaughterings are wholly meritorious and should not be allowed to influence anyone into thinking that useful breeding stock is being sacrificed simply for present high returns.

The buoyant nature of the beef market, coupled with encouraging results from research into pasture improvement in beef cattle areas, has stimulated wide interest in this work.

The outstanding results achieved over at least 12 years at the Bureau of Tropical Agriculture in the successful fattening of young cattle are being accepted by the graziers of North Queensland. Improved pastures incorporating the legume centre are being established in individual areas of up to 1,000 acres in coastal areas for the purpose of fattening cattle bred in the drier hinterland. Some graziers with properties in the hinterland have bought their own coastal properties on which to establish pastures for fattening their young bullocks.

Successful grazing trials on sown pastures at "Brian Pastures" have shown that over a period of years the usual losses of animal weight in winter can be transformed into gains and that the production of beef per acre can be trebled in comparison with that on native pastures. The elimination of winter liveweight losses make it possible to market fats at 2½-3 years of age. This work is arousing active interest among graziers.

In the Burnett area generally, interest in pasture improvement has quickened. Prior to 1954 there were no tractors and agricultural machinery on grazing properties in the Eidsvold area. There are now in this district at least 10 graziers with machinery who are undertaking cropping and pasture improvement programmes. Similar interest and activity is reported from the cattle country watered by the Fitzroy and its tributaries.

The recognition of lucerne as a pasture plant, the ability to clear brigalow country rapidly and at reasonable cost by mechanical means, and the use of aerial broadcasting have combined to increase pasture establishment in scrub lands, particularly in the Central Highlands.

The use of buffel grass in cattle pastures is being developed in beef country in many areas, as for example in north-western Queensland and in the Nebo country west of Mackay.

A survey of the present beef cattle fattening areas in Queensland has indicated that the application of existing technical knowledge to properties already carrying beef cattle could result in an increased turnoff of 750,000 fat cattle per year over the 1,250,000 animals slaughtered in each of the last three years.

DAIRY PRODUCTS

With improved seasonal conditions, production of butter and cheese in Australia increased by 11 per cent. and 21 per cent. in 1958-59 to 192,059 tons and 41,872 tons respectively. The increase in butter was mainly in Queensland and New South Wales, while cheese production increased in all States. In Queensland, butter production increased by 27 per cent. and cheese by 58 per cent.

During the year, butter prices on the United Kingdom market improved from the low level of 205s. stg. per cwt. in May 1958, to 343s. stg. per cwt. in June 1959. The price improvement fortunately came after increased shipments from Australia, but at a time when exports from European and New Zealand suppliers were lower than in the previous year and when local United Kingdom production was also lower. The United Kingdom cheese market has been very firm since November, as a result of a shortage of local cheeses.

A pleasing feature of the British market was the narrowing of the price margin between Australian and New Zealand cheese. Currently, this is only 1s. per cwt. in favour of New Zealand cheese, whereas at times in recent years the difference has been as much as 15s. per cwt. This satisfactory position is in some measure due to the intensive quality improvement efforts which have been made by the Australian cheese industry during the past three years. The enhanced reputation of Australian cheese among British consumers should be maintained as a result of the efforts which the Australian industry is making at further improvement in quality and the presentation of cheese. Reports from Britain indicate that surface defects, which were prevalent two or three years ago in Australian cheese, have appreciably diminished. A decision to wax all export cheese was made voluntarily by cheese industry organisations.

The future of overseas markets will continue to remain uncertain as long as heavy stocks, although somewhat less than last year, exist on the North American continent, and a high level of milk production in the United Kingdom is maintained in accordance with the agricultural policy of that country. Accordingly, in Australia, attention is being concentrated on attaining improved quality and technical efficiency, and on intensified sales promotion.

A scheme for the promotion of sales of dairy products within Australia and extending research into problems of the industry in both the production and manufacturing phases was put into operation during the year after the passing of the necessary enabling legislation by the Commonwealth Government. The scheme will be financed by levies on all butter and cheese factories not exceeding $\frac{1}{4}$ d. per lb. butter and $\frac{1}{16}$ d. per lb. cheese manufactured. The levies are expected to provide approximately £300,000 yearly. That portion of the fund which is used for research projects approved by the Commonwealth Government will be subsidised by the Government on a £ for £ basis. A special Committee of the Australian Dairy Produce Board which is administering the scheme decided that for the first year the monies

collected will be divided equally between promotion and research. Commonwealth organisations, State Departments, Universities and various industry organisations have been requested to supply details of present research activities and any expansion which would be carried out if funds were provided from the scheme. The Committee will examine the proposals submitted to it and then determine which activities it will assist financially. It is envisaged that the promotion activities will stimulate increased consumption of dairy products in Australia, and the extension of research on major problems will aid the general economic improvement of the industry.

The Australian Dairy Farmers' Federation made a submission to the Joint Dairy Industry Investigation Committee that a farm cost of 53d. per lb. commercial butter, the same as in the preceding year, should be regarded as the cost of production for the purpose of the Commonwealth Government's guaranteed price scheme to the dairy industry for 1959-60.

The Minister for Primary Industry announced in June 1959 that the Commonwealth Government had decided to continue the Commonwealth Government's subsidy for 1959-60 at £13,500,000 and there would be no change from July 1, 1959, in the ex factory prices for butter and cheese sold within Australia. The Commonwealth Government also agreed to underwrite a final equalisation payment for butter and cheese factories for 1959-60, which will enable the factories to pay producers at least 40d. per lb. commercial butter basis. The difference between the guaranteed farm costs and the equalisation value is due to the Commonwealth Government's guaranteed price relating only to butter and cheese sold within Australia plus exports equivalent to one-fifth thereof. The interim return to producers is below the farm cost in Australia on account of the prices received for the exportable surplus being considerably below Australian costs of production. Under the existing marketing conditions the final payout cannot be determined until at least 12 months after the end of any year. It is estimated that the better overseas values this year will enable a final return to farmers for 1957-58 of at least 3s. 7 $\frac{1}{2}$ d. per lb. commercial butter or 4s. 5 $\frac{1}{2}$ d. per lb. butterfat, compared with the interim factory payout of 3s. 1d. per lb.

The industry is concerned at the widening gap between local market prices and the equalised returns paid to factories as contributors to the voluntary Commonwealth Equalisation Scheme. Industry leaders and the Federal Government are concerned with the potential threat to the stability of the industry which would arise from the withdrawal of manufacturers from the scheme.

In the post-war years Queensland's dairy cattle population has tended to decline and the population recorded at Mar. 31, 1958, was the lowest since 1933. The fall in cattle numbers to this date was, no doubt, partly due to drought but it is also a reflection of the effect of rising costs of production on the profitability of the industry. The decline in numbers of dairy cattle has been greatest in the Darling Downs statistical division and this is almost certainly due to the fact that there are greater opportunities for methods of land use alternative to dairying in that division than in the other dairying districts of the State.

Estimates of the production of milk and butter-fat per cow provided by the Commonwealth Statistician and by herd recording data indicate that output has remained static in Queensland over the past 10 years apart from fluctuations caused by seasonal conditions. In contrast, production per cow in the southern States of Australia has increased over the same period by some 20 per cent. In consequence, the proportion of Australia's dairy output produced in Queensland is declining.

Pasture problems in the dairying industry remain in principle the same as those for the rest of the State, namely the rapid decline in yield, palatability and nutritive value of the pastures during the winter and spring months. Additional problems which are acute in districts such as the Near North Coast include the serious decline in pasture productivity and the invasion of weed species.

A vigorous programme of experimental work is in progress in which the materials and incidental expenses are financed from grants from the Australian Dairy Produce Board and Shell Chemical (Aust.) Pty. Ltd. Eighty-one projects have been conducted during the year, covering the main dairying districts from the Atherton Tableland to the southern border and as far west as Chinchilla.

Significant results have been achieved in many of the current trials, and it can be expected that adoption of improved practices will follow as local economic conditions permit. Farmers supplying wholemilk for city and town consumption are finding that the increased returns coupled with the maintenance of year-round production make improved pastures an economic proposition. Examples of outstanding results can be found over a wide range of districts.

An unsuspected but significant response to potash has been reported from irrigated pastures on heavy black soils at Glengallan. The residual effect of this expensive fertilizer will determine whether the increased yields will be economic.

Lucerne continues to show out as a useful pasture legume in mixtures with Rhodes grass, green panic and buffel grass on suitable soils. Mixtures of lucerne with Rhodes grass or green panic have given two to three times the yield of native pastures for dairy stock. Seven-year-old green panic/lucerne dairy pastures have made remarkable recovery following the last drought.

Mixtures of molasses grass and centro have given a measure of weed control in addition to supplying valuable feed on frost-free slopes of southern coastal Queensland in bracken and groundsel infested areas. The legumes centro and stylo in mixtures with molasses grass have produced up to 6 tons of air-dry hay in 16 months on blady grass ridges near Currumbin.

The results achieved with superphosphate, and superphosphate plus sulphate of ammonia, in south-eastern Queensland have been repeated in dairy districts around Mackay. Here, the success of renovation, oversowing and topdressing in increasing pasture yields and reducing mat grass infestation has encouraged farmers to expand their areas of improved pastures.

Irrigated pastures are playing an increasing part in providing stability in the dairying industry.

Areas sown to irrigated pastures have increased in all south-eastern districts where adequate water is readily available.

EGGS

An interesting development has taken place in the egg industry, in the formation of the Egg Marketing Board Suppliers' Organisation, which held its inaugural meeting on June 4, 1959. This is the first field organisation established by a commodity marketing board under powers given to boards by the 1938 amendments to the Primary Producers' Organisation and Marketing Acts. In the past, growers' organisations, both statutory and voluntary in character, have been formed quite independently of the particular commodity board; this has often led to uninformed criticism, of a destructive nature, of the policies and operations of particular commodity boards. It has also resulted in conflicting advice being tendered to the Government on industry matters. The new organisation, the membership of which is closely integrated with Egg Marketing Board membership, is experimental in character, and its activities will be watched with interest.

The economic position of the commercial poultry industry in Queensland improved in comparison with recent past seasons. The availability of feedstuffs improved and at prices estimated, on average, at about 20 per cent. below those of the previous season. Net average returns to suppliers to the Egg Marketing Board also increased from 43·36d. to 44·90d. per doz. The quantity of eggs marketed by the egg marketing boards in Queensland increased by 10 per cent. over the previous season to 8·7m. doz.

Despite cuts by the United Kingdom government in the last two seasons, in the guaranteed prices for eggs, production there has continued to expand. The subsidy earlier this year, during the flush season, amounted to about a third of their market value. For 1959-60 the guaranteed price will be reduced by another 1d. per doz.

As a result of low prices in the United Kingdom a larger proportion of exports has been made to European continental outlets. The average net return to the Australian Egg Board—which marketed exports on behalf of all State egg marketing boards except New South Wales—was 2s. 11·004d. per doz. (Australian currency), slightly less than the figure of 2s. 11·391d. per doz. realised for the previous season. Sales of egg pulp in the United Kingdom were made at an average price of £222 stg. per ton, which was slightly below the previous year's level.

As with the dairy industry the egg marketing organisation realised the uncertainty of overseas outlets for supplies surplus to local requirements. Efforts have been concentrated on improving handling efficiency, service, quality standards and package presentation, as a means of both holding down marketing costs and promoting local sales. The construction of a new building to house administration, sales, and refrigeration equipment, adjoining the grading floor, has concentrated activities at one site, and materially assisted in improving handling efficiency. Growers themselves have assisted by adopting changed husbandry practices, which have resulted in modification of the production pattern. This has resulted in higher production in the later summer and autumn months and a scaling down of the spring peak.

PIG INDUSTRY

A Committee representing various interests was set up by the Minister for Agriculture and Stock during the year to inquire into various aspects of pig production and manufacture and marketing of pigmeats. The Committee is to visit the main producing areas in order to give pig raisers every opportunity to present their views in person.

Though the market for pigmeats was fairly stable during the past year, there have been wide fluctuations in recent years and one of the main objects of the Committee of Inquiry is to suggest means of stabilising the industry. Special attention is being given to carcase grading, a pig production forecasting service, sales promotion and production research.

PASTURES

As mentioned in previous sections of this report the interest of graziers and dairy farmers in pasture improvement has been strongly maintained. One indication of this is the continuing strong support for the Royal National Association's Pasture Improvement Competition, in which 102 entries were received for 1958-59. Research into pasture problems is being maintained and 215 pasture trials and plots and 121 demonstration projects were in progress during the year on co-operator's properties, in addition to trials being conducted on Experiment Stations.

District field trials and demonstrations are supported in part from outside sources, including the Australian Dairy Produce Board, Commonwealth Extension Services Grant, Commonwealth Dairy Industry Extension Grant, Wool Research Fund, and grants from private industry.

Pasture research is being carried out on four experiment stations besides several Regional Experiment Stations.

On the Parada Tobacco Experiment Station, irrigated pastures are being studied with a view to providing alternative methods of land use on soil not suited to tobacco, and also to determining suitable rotations to be used with tobacco.

At the Bureau of Tropical Agriculture, South Johnstone, and the associated sub-station of Utchee Creek, work is being conducted on pasture species and their management under high-rainfall, tropical coastal conditions. The results obtained with the tropical legumes centro and stylo on this Station have revolutionised the approach to cattle fattening in the tropics.

The Australian Meat Board's property, "Brian Pastures" Beef Cattle Pasture Research Station at Gayndah, is managed by the Queensland Department of Agriculture and Stock, which is carrying out the great bulk of its research programme. Some 32 trials being conducted by the Department on this Station are examining problems related to beef cattle pastures and their management.

The fourth station is the Toorak Field Station in north-western Queensland, where a study is being made of certain problems in the sheep pastures of the region.

The supply of seed of certain important grasses and legumes remains a problem. Techniques for harvesting centro on a commercial scale are now available. One grazier near Ingham has already harvested and marketed seed of this legume, and pure seed plots have been established in the Ayr district as a step towards making the State self-sufficient for this seed. Techniques are also available, following work by Regional Experiment Station officers, for harvesting of stylo and glycine. It can now be expected that when mother seed stocks are available commercial production of these seeds will begin.

Supplies are adequate for most seeds of proven grasses in use or in demand with the exception of scrobie. A grazier in the Gin Gin district where this grass has shown outstanding promise has now succeeded in harvesting this seed with an all-crop harvester. It can be expected that seed supplies of this grass will steadily increase as a result of this work.

In pastoral areas where land values and returns per acre are low, successful pasture establishment will depend to a large extent on much cheaper commercial seed, or the production of seed requirements on each property. Achievements of graziers in the Dirranbandi, Blackall and Cloncurry districts have shown this recommendation to be both essential and practicable.

BRIGALOW CONTROL

The brigalow belt is a large and potentially very productive portion of Queensland. A major problem in the permanent development of this country is how to control the regrowth of brigalow suckers which, if unchecked, will create a worse situation than the original vegetation.

A survey of the methods at present in use for clearing brigalow land and of their efficacy was continued. An important observation was that, irrespective of whether brigalow was pulled, ring-barked or treated with chemicals, best killing results were obtained when the operation was carried out when the soil had a high moisture content.

Where sheep are used to graze suckers, adequate fencing and watering facilities are essential. In cattle country where the practice is to sow pastures, such facilities are equally necessary in order to permit proper establishment of the pastures. Whatever stock are used, however, areas larger than those which can be handled efficiently should not be cleared. Otherwise regrowth is liable to get out of hand.

The economic destruction of old stunted brigalow suckers remains most difficult. Further studies on chemical control of this type of brigalow are being made but it will be about two years before the aerial spraying trials can be evaluated.

The effective utilization of the brigalow land could mean a large increase in the production of beef, wool, grain and cotton in this State and it is essential therefore that investigations be continued as far as facilities and finance permit.

SOIL CONSERVATION

An area of over 3 million acres of land in the State is now cultivated for crop production. Under existing land-use systems and because of peculiarities of climate and soil type, a relatively high proportion of the area is subject to water erosion. It is estimated that over 1 million acres of this land requires the early application of measures to provide for the interception and stable disposal of surplus runoff.

The past year was one of average rainfall in most of the agricultural districts, and erosion did not occur in widespread district patterns.

On the Darling Downs heavy storms caused moderate to severe erosion in isolated sections of all sub-districts. These storms, with intensity rates of up to 5 in. per hour, particularly affected the Warwick and Pittsworth districts, causing serious erosion on unprotected land and resulting in some failures of interception structures where they had not received adequate maintenance. Structures in good condition functioned very satisfactorily.

Flood rains in February resulted in widespread erosion on the south-eastern Darling Downs. Heavy rains in the Dalby district in June 1958 caused widespread flooding of low-gradient agricultural lands with quite serious associated erosion and siltation problems.

In general, soil erosion in the Burnett district was not severe, though in isolated areas serious erosion occurred from storms with intensity rates of up to 5 in. per hour. The damage was restricted to the paths of the storms, and as usual the extent of damage decreased as the summer season advanced and crops provided greater protection. Rainfalls of 4-6 in. in June 1958 caused serious sheet erosion and some gully erosion on fallowed areas, but the greater part of the area benefited from the protection of existing crops. Interception structures functioned very well except where maintenance had been neglected and where in one instance hail choked a waterway and caused overtopping of adjacent contour banks.

At Atherton there was very little erosion over a widespread area because of the lack of high-intensity storms at the period when the soils were most vulnerable. However, isolated high-intensity storms caused serious damage to small areas.

Serious sheet erosion occurred in many cultivation paddocks in the newly settled Central Highlands area during the February flood rains. Soil conservation structures performed satisfactorily.

Conservation Farming

During the preceding five years there was evidence suggesting that Darling Downs farmers had appreciated the harmful effects of continuous stubble burning. Each year saw a reduction in the number of stubble fires and it was felt that the Department's extension efforts were bearing fruit.

The year under review has shown that the reduction in stubble burning was only a temporary phase, stubble fires being a common sight

at the end of the last wheat season. The reason for this was, in many cases, that after the preceding drought year with associated reduced income many farmers decided to "double-crop" for immediate financial reasons. In many cases the wheat stubble was burnt and a summer crop planted immediately. The stubble from this was burnt in the autumn in preparation for another wheat or barley crop. This is an unfortunate trend, for it shows that good agronomy is still subservient to immediate financial considerations. While there may be good reasons for this from the landholder's viewpoint, continuation of this exploitative outlook does not promise a stable future for these agricultural lands.

Tined implements are finding increasing use on farms and are helping farmers in their efforts to avoid the fine dusty fallows which are very susceptible to erosion. There appears to be a trend towards the rougher fallow on the Darling Downs; this, if sustained, should help to reduce the erosion hazard.

Flooding of the Darling Downs open plains areas is now occurring more frequently than heretofore and the damage occurring emphasises the weaknesses in existing farming practices. Long continuous stretches of fallowed land offer no barrier to accumulated runoff water which cannot be absorbed during periods of continuous heavy rain.

In June 1958 serious flooding, erosion and siltation problems were evident on much of the Dalby plains country. The financial losses were quite substantial. These losses could be materially reduced by the rotation of crops which would be planted on the contour in alternating strips. However, the greatest benefit would accrue if additional strips of a perennial crop such as lucerne or pasture were included.

A strip-cropping project has been in operation on a property near Jondaryan for two years and so far the results have been distinctly beneficial. To be completely successful these strip-cropping projects should be associated with planned runoff interception and disposal systems.

Maize monoculture continues to be the dominant practice on the Atherton Tableland and if anything the year under review has shown a slight trend away from mixed farming in the agricultural section of the Tableland.

In the Burnett district the trend is also in the wrong direction, agronomically, since high peanut prices and lower prices for some animal products have combined to bring about a lessened interest in livestock and an enhanced interest in crop production. The Gurgeena Plateau was formerly a dairying area but the whole of the plateau is now devoted to crop production. In the South Burnett there is an increasing use of marginal land for peanut production, and sandy forest soils are being cleared for this purpose.

Sheep are now a less attractive proposition to the South Burnett farmer because of management troubles and the decline in wool prices. It is hoped that this is only a temporary trend, since sheep appeared to offer the greatest promise for encouraging the development of ley pasture systems in the area.

In the whole-State picture, therefore, it is not possible to report any encouraging developments during the year which might suggest a general adoption of conservation farming procedures. This is a matter for concern, since it implies that the extension methods which are successful in relation to the installation of protective structures are failing to impress farmers in the matter of agronomic measures. Perhaps the difference lies in the fact that it has been possible to give clear-cut proof of the benefits of mechanical control, but not of agronomic control. If this analysis is correct, the obvious course is to adopt a campaign aimed at demonstrating the benefits of good farming methods in relation to the overall conservation plan.

Farm and Catchment Planning

The farming community is almost entirely dependent on Departmental services for the preparation of plans showing the location and size of structures required to control and direct the flow of runoff water.

Detailed plans are required for over 7½ million acres of land in the Darling Downs and Burnett areas alone. Before planning of conservation measures can commence it is necessary to prepare base plans showing topographic and property data. This aspect of the work will involve 6,000 man-days of technical time.

A total of 45,000 man-days will be required to develop the group conservation plans for these two districts.

With the present staff establishment, keeping in mind existent commitments in surveying and associated activities, it is probable that it will take seven years to complete the base plans and over 20 years to complete the conservation plans for the areas in question. The actual implementation of planned works by farmers could well extend beyond 50 years.

Soil Conservation Co-ordination

The Advisory and Co-ordinating Committee on Soil Conservation, of which the Director-General of Agriculture and Stock is Chairman, met once during the year and arranged the establishment of District Soil Conservation Committees for the Darling Downs, South Burnett and Atherton regions. The inaugural meetings of these Committees were held with the objective of co-ordinated development of drainage schemes affecting farmers, Shire Councils, the Department of Main Roads, and the Department of Railways.

Another progressive move has been the establishment of soil conservation sub-committees by two local authorities for the purpose of co-ordinating Shire Council activities with district soil conservation needs. Results to date suggest that this approach could provide a very effective liaison between local authorities and soil conservation extension officers of this Department.

FACILITIES FOR RESEARCH

It is pleasing to be able to record that the past year has been a memorable one in the provision of facilities for rural research in Queensland.

Within the Department of Agriculture and Stock, the most noteworthy items in this respect are, perhaps, the progress on the Fruit Preser-

vation Research Laboratory at Hamilton, developments at the Rocklea Animal Husbandry Research Farm, the more extensive use of facilities at Brian Pastures Research Station, developments at Millaroo Regional Experiment Station, and progress at Parada Tobacco Experiment Station.

The laboratory now nearing completion at Hamilton for research into problems of storage and transport of fruit and vegetables has before it a substantial programme of investigations. As might be expected from consideration of climate and distances from principal markets, fruit and vegetable growers sustain considerable loss in marketing their produce. Now that research workers are about to get to grips with the more important problems, a progressive improvement in this situation is anticipated.

At Rocklea Animal Husbandry Farm, which is an annexe of the Animal Research Institute, the Pig Testing Station was brought into operation during the year. Facilities of world standard are available at this Station and a most fruitful period lies ahead. Facilities for poultry testing have been increased and the Department's efforts in this direction are well in line with those of other States conducting poultry improvement programmes.

The Australian Meat Board, through the Australian Beef Cattle Research Committee, provided extensive facilities at Brian Pastures Research Station in the initial years of the development of the Station. Pending the outcome of exploratory trials, these facilities were not fully used. During the past year, however, a set of important experiments based on the results of the exploratory work was set in train and the facilities referred to are now being most fruitfully utilized.

The accelerated development of Millaroo Regional Experiment Station in the Burdekin Valley is of some moment, inasmuch as every additional season of experimentation brings nearer the time when the pattern of development of the resources of the valley can be predetermined on a sound basis.

Likewise, it is satisfying to note the progress made in the development of the Parada Tobacco Research Station, in the Mareeba-Dimbulah Irrigation Area. The economic development of this area will depend largely on the success with which tobacco can be grown. The expanded research activities projected at the Parada Station will have an important part to play in that respect.

Quite apart from the satisfaction with progress on projects conducted by the Department, it is pleasing also to refer to developments in allied spheres. The formation of the C.S.I.R.O. Division of Tropical Pastures and its establishment in modern laboratories at St. Lucia is assuredly the forerunner of important work in agrostology. In sugar cane technology, also, the opening of new laboratories for the Bureau of Sugar Experiment Stations will stimulate research. New facilities for teaching and research in the University Departments of Agriculture and Veterinary Science will have their effects on the operations of the Department of Agriculture and Stock as graduates of the future come into its service.

STAFF

Viewed from the numerical standpoint the overall staff position improved during the period under review. Thus whilst 14 graduate officers were lost we were able to secure 17 new men of similar qualifications on the permanent staff. Similarly, against 4 resignations of diploma holders 7 new men were recruited, again on the permanent staff.

The temporary staff position has made greater gains in that we lost no graduates but gained six and in the technical grades our net gain was 13 after losing only one. These men are for the most part paid from grants made by the Commonwealth Government. That they are only temporarily employed is due to nature of the grants, which in the main are committed for a maximum period of five years.

As at the end of the financial year it was considered that in order to fulfill our obligations to all whom the Department is called upon to serve, we still needed some 76 more officers. There is, of course, no possibility that that number will be recruited in the foreseeable future, since apart from all other considerations there is nothing approaching that figure available.

Our most serious losses occurred in the ranks of veterinarians, of whom no fewer than five resigned within a few weeks. Very careful consideration has been given to this particular aspect and it seems inevitable that as far as is consistent with the problems being handled we will have to look to graduates in pure science and agriculture to form the backbone of our animal research teams. We simply cannot hope to conduct long-term research with nomadic personnel.

Consequent on the elevation of Mr. W. Webster to the position of Deputy Director-General of Agriculture, Mr. A. L. Clay was appointed Director, Division of Animal Industry, with Mr. C. R. Mulhearn as Assistant Director.

Mr. W. G. Wells retired at the end of 1958 under age provisions and his position as Director, Division of Plant Industry, was filled by Mr. W. J. S. Sloan, formerly Director of Agriculture. This latter position was assumed by Dr. L. G. Miles and Mr. S. Marriott became Assistant Director.

During the year seven officers were awarded University degrees and four others obtained further degrees, three of them, including one Doctorate in Philosophy, from overseas universities. Our most pressing need is to provide the facilities to enable our well-trained staff to give of their best and much is being done in this direction as recorded elsewhere in this report.

During the year 11 officers made overseas visits.

Dr. J. M. Harvey, who is still abroad, is undertaking a study tour in U.S.A., the United Kingdom and part of Europe. He is working in the field of biochemistry and concentrating on modern techniques in the study of animal nutrition.

Mr. C. R. Mulhearn proceeded overseas essentially at the request of Commonwealth authorities to take part in a conference on tick problems. The opportunity was taken to allow Mr. Mulhearn to visit a number of leading institutions concerned with work in animal diseases.

The occurrence of suspected equine infectious anaemia made a visit by Mr. L. G. Newton to Japan imperative. Mr. Newton, with great assistance from the Japanese authorities, was able to make a thorough study of certain aspects of the trouble. Mr. Newton also visited the Philippines to assist the trade in cattle from Queensland with particular respect to pleuropneumonia testing.

Another officer of the Division of Animal Industry, Mr. K. M. Grant, made a brief special-purpose trip to the Philippines in connection with the transport of stock being exported to that country.

Mr. B. J. Crack was awarded a King George VI. memorial fellowship by the Trustees of the English Speaking Union of U.S.A. and has been granted leave and some subsidiary assistance to enable him to study soil chemistry at the University of California.

Mr. J. G. Morris proceeded overseas on special leave to enable him to further his studies at the University of Utah. He, too, is being given some assistance.

Mr. V. R. Smythe carried out an assignment for the Food and Agriculture Organisation of the United Nations. His mission was to examine and report on aspects of dairy technology in Thailand and the Philippines.

Mr. S. E. Pegg paid a visit of short duration to New Zealand to study at first hand the system and results of herd recording in that country. This was a very worthwhile trip and will, it is felt, help the Department in solving some of the rather thorny problems which face us in this field.

Mr. T. J. Beckman, was awarded a scholarship by the French Government which has enabled him to study isotope chemistry in Paris.

Mr. J. L. Clayton, of the Central Sugar Cane Prices Board, and I, as Deputy Chairman of the Bureau of Sugar Experiment Stations Board, attended the International Sugar Cane Technologists Conference in Hawaii in May last.

It is felt that each of these overseas visits has been time well spent and must help increase the efficiency of each of the participating officers. In each case some financial assistance has been received from outside organisations.

Another method of increasing efficiency, and at the same time measuring this, has been the introduction of a system of internal promotional examinations. The nature and purpose of these was misunderstood in some instances but there is now no doubt that these examinations and more particularly the studies necessary as a preliminary are serving a most useful purpose and not in any way penalising officers who are prepared to keep themselves abreast of modern developments in the various appropriate fields of applied agriculture.

ACKNOWLEDGEMENTS

It is desired to acknowledge the co-operation and assistance of other Government Departments (in particular, the Treasury and the Irrigation and Water Supply Commission) and various individuals and organisations.

REPORTS OF ACTIVITIES

The work of the various Sections and Branches is described in some detail in the sections which follow.

DIVISION OF PLANT INDUSTRY

Work of the Division continued over a wide range of activities concerned with the improvement of agriculture, other than sugar-cane growing, in Queensland.

Seasonal conditions were generally favourable and prospects for the ensuing year are encouraging.

RESEARCH

Fifteen Experiment Stations are now operated within the Division of Plant Industry. These Stations are located in farming areas from as far north as Kairi on the Atherton Tableland to Hermitage, near Warwick, in southern Queensland. Officers of the Division also work on three Experiment Stations controlled by other authorities, principally in the field of pasture research.

Development of the experiment station system has occurred mainly in the last decade and, as might be expected, none of these Stations is yet equipped fully with the facilities and staff required to undertake the accurate and painstaking observations which research programmes demand.

Progress is being made steadily and again this year improvements have been effected on several Stations with new buildings and additional equipment.

In this year, Queensland's celebration of its attainment of 100 years as a State, it is well to pause and reflect on how far we have come. Tribute must be paid to the pioneers who have made such excellent contributions in developing farming in this State.

Although many of the less complex problems in farming have been solved by producers of the past and present, there are complicated problems which are beyond the resources of individuals. It is in these directions that efficient teams of research workers equipped with adequate facilities are needed. This requires money, because intensive research on soil and plant problems cannot be done cheaply.

The interest shown by primary producers in providing finance for additional research is a pleasing feature in recent years. For some time sugar producers, with their Bureau of Sugar Experiment Stations, have been cited as the model for this approach.

Tobacco growers, by way of the Tobacco Industry Trust Account, have already shown their determination to develop improved techniques in producing quality tobacco. Facilities have been created on experiment stations at Inglewood and Parada and a team of qualified technical officers is being assembled. The volume of experimental work is being increased and valuable results from these investigations can be expected.

With funds made available from pineapple growers, a Chief Plant Physiologist, Dr. R. F. Black, was appointed in 1958, and with the proposed erection of a laboratory and glasshouse at Nambour, a greatly increased programme of investigations on pineapples should be possible in the near future.

Wheat growers have also acted to create extra funds for research on wheat-growing problems. A research centre is to be constructed at Toowoomba and Divisional officers are expected to play an important role in the investigations on diseases and soil fertility.

With the expansion of irrigation in Queensland as a result of both individual units and storage dams, built by the Irrigation and Water Supply Commission, supplying a number of farms, the need for intensified research on water-soil-plant relationships is apparent. Large sums of money have been and are being spent on irrigation projects. Efficient use of water is required if maximum production at an economic level is to be obtained.

Divisional staff have taken a prominent part in soil survey work associated with the planning of settlements which will be established to utilize water for irrigation impounded by the Tinaroo Dam on the Barron River. Research on tobacco and other crops likely to be suitable for the soils in the area to be commanded by irrigation water is an important activity of the Parada Tobacco Experiment Station. Further impetus will be given to this research by the development of another Experiment Station at Walkamin.

EXTENSION

In a large State like Queensland, where farming areas are distributed over more than a thousand miles from south to north, representing many soil types and climates, there is no question that research and experimentation with soils and plants is a pressing necessity. At the same time, it is equally important that the results of investigations be communicated to farmers in a way they can understand.

Keeping farmers informed on better farming techniques is a major responsibility of the field staff of the Division of Plant Industry. How to communicate that information most effectively to farmers is in itself a problem, and in recent years a series of schools to train field officers of all Divisions in methods of more efficient communication have been conducted within the Department.

Already the beneficial results of these schools can be seen. Field officers are more and more making use of newspapers, producer publications, films, radio, field days, farmer meetings and exhibits to interest farmers in better production methods. A notable development has been the widespread use of coloured slides made possible by providing field staff with suitable cameras and projection equipment.

The work of field officers, however, cannot be effective without the co-operation of farmers and their local and State organisations. It is gratifying to note that farming communities are becoming increasingly aware of the part they can play in improving agriculture in their areas. In many districts local farmer groups are actively assisting field officers in their efforts to spread information on improved techniques.

Although an excellent beginning has been made in recent years in stimulating group action for better farming, there is scope for much wider application of community participation in this way. The Junior Farmers' Organisation, comprising young and mentally-active people, is one avenue which merits greater attention in this regard.

The Commonwealth Extension Services Grant has been most valuable in providing an improved advisory service. The appointment of a number of temporary officers, the purchase of suitable transport, the financing of equipment for extension purposes and the availability of funds for demonstrations have facilitated the opening of new centres and improved the extension services in already established offices.

STAFF

No radical changes have taken place in the major staff groupings during the year but there has been a slight improvement in the overall numerical strength of graduates. Although this is reasonably satisfactory and enables existing activities to be maintained, it does not

provide the immediate means of catering for other pressing commitments, particularly from the viewpoint that induction and practical training of new appointees necessarily takes time before they have the experience to produce results comparable with the work of their predecessors.

In this regard therefore the system of recruiting Divisional trainees by cadetships and scholarships continues to be indispensable to the long-term planning of staff policy. It is particularly valuable in providing an annual staff increment of young graduates who have both practical experience of and academic qualifications for the work to be done.

On the extension side of the Division's responsibilities, the normal pattern of staff changes has resulted in losses of experienced advisory officers. The untimely death of Mr. I. S. Wilson, Adviser in charge of the Horticulture Experiment Station at Redlands, is recorded with deep regret. Two other widely experienced officers—Mr. O. L. Hassell, Senior Adviser in Agriculture, and Mr. A. M. Richardson, Adviser in Horticulture—were lost by retirement after having reached the prescribed age limit. Resignations accounted for further losses.

Although the extension and experimental staff is well supported by a nucleus of younger men who have the enthusiasm and efficiency to enable normal activities to

proceed without interruption, there are still as yet not enough of them to meet the constant and increasing demands for additional or expanded services.

In both laboratory and field therefore a realistic assessment of the Division's staff requirements shows that much still remains to be achieved. With the present rate of progress of modern farming practices, increasing awareness among producers of the need to adopt advanced methods, the cropping changes taking place in established districts and moves to open up new districts, a much larger excess of recruitments over losses is necessary before the staff position can be considered satisfactory.

Some administrative changes occurred following the retirement of Mr. W. G. Wells, Director, Division of Plant Industry, under the age limit provisions. Mr. Wells' association with the Department began in 1923 with work on the agronomy of cotton. In 1947 he was made responsible for the development of experiment stations on a regional basis and in 1957 was promoted to the position of Director, Division of Plant Industry.

This position has now been filled by the promotion of Mr. W. J. S. Sloan, previously Director of Agriculture, whilst Dr. L. G. Miles has been promoted to the latter position. Further consequential vacancies resulted in the appointment of Mr. S. Marriott as Assistant Director of Agriculture and Mr. L. R. Humphreys as Chief Agrostologist.

AGRICULTURE BRANCH

The main function of the Agriculture Branch is to provide an advisory service to primary producers in matters concerning the production of pastures and of all agricultural crops except sugar-cane. In addition, it provides the major Governmental service to landholders in the field of soil conservation.

In respect of both agricultural crops and soil conservation, the Branch's work is concentrated in the main agricultural districts of the coast and near hinterland. The requirement for pasture advisory services is, however, State-wide. The greatest concentration of effort in this field has naturally been in the more closely settled dairying districts, but in recent years there have been greatly increased demands for services in both the sheep and the beef cattle zones. These demands are being met, as staff becomes available, by the stationing of agrostologists in western or mid-western centres.

From the foregoing, the main Branch functions may rightly be considered to be within the field of agricultural extension. Good extension, however, requires sound basic information and much of this information can only be obtained from carefully conducted trials on experiment stations. The Branch has thus to run some experiment stations to supplement the work of the Regional Experiment Stations Branch, particularly with respect to pastures and tobacco.

In a State the size of Queensland, however, where problems are so diverse and population so small, it is clearly impossible to provide experiment stations to serve every agricultural and pastoral district. Thus most field officers, when confronted with district problems, have to devise a programme of trials on farms to provide them with some of the answers to those problems.

Virtually every so-called advisory officer is therefore part adviser and part experimenter. With some, the time devoted to experimental work is of necessity greater than that available for extension. Many such trials do, of course, serve a dual purpose, since they can also be used as extension demonstrations.

The major results of the Branch's experimental and soil conservation planning programmes are summarised in the following sections.

In the field of extension, increasing attention has had to be given to making the most efficient possible use of the Adviser's somewhat limited time. This has been attempted by concentrating on the so-called "mass media" of education, principally the local press, radio, meetings, tours, field days and the like.

One of the biggest aids to this form of extension in the Agriculture Branch is the 35 mm. camera, which is capable of taking colour pictures for slide projection. Practically all Advisers now have access to such a camera and have some skill in its use. As a result, each district office is now accumulating a valuable collection of colour slides showing desirable and undesirable agricultural practices in an easily assimilable form. These slides have added value for the rural community, since the majority of them will be both local and topical.

While it is generally agreed that the Branch is by these means providing a better advisory service than ever before, advisory officers are all convinced that the farm visit still remains the basic requirement of most successful extension. This applies not only to the provision of a skilled service (e.g. surveying and planning for soil conservation) and to the transmission of actual skills (e.g. curing and grading of tobacco), but also to the communication of ideas and general knowledge.

Experience generally has been that the mass media draw attention to problems and to the need for improvement; action mainly results from person to person contact, preferably on the farmer's property.

FIELD CROPS

Wheat

The highlights of the year's activities include the seed increase of three new crossbreds prior to naming and release as new varieties; the completion of three years' study of the effect of nitrogen fertilizers on yield and quality; the collection of further evidence to support the value of lucerne in the cereal cropping system; and the completion of the first year's activities on an 8-year cycle rotation trial including wheat and pasture on the open plains of the Darling Downs.

A full programme of plant breeding has been carried through at Hermitage Regional Experiment Station, with attention being given principally to rust and frost resistance, yield and flour quality. A number of promising crossbreds which have performed well in comparison with standard varieties have been selected for further testing.

At Hermitage and on the open plains of the Darling Downs, promising new crosses were compared against standard commercial varieties in the three maturity groups—early, mid-season and late. All of these trials were planted towards the end of June and suffered severe damage from frosts on July 13-14 and Sept. 19.

A new strain of stem rust took toll of some of the popular varieties, notably Gabo, and their yields were considerably reduced. Spica, Festival and Lawrence retained their stem rust resistance in the face of the new strain of rust. These three varieties will have to provide the bulk of the Queensland crop until the plant breeder's new releases have been effectually increased.

Among the early varieties the new backcross derivative of Puora, which is to be released under the name of Kenora, significantly outyielded both Spica and Gabo. Spica was severely affected by frost and Gabo by stem rust. Of the mid-season varieties, six new crossbreds, including the Lawrence x Gabo strain which it is hoped to release as Gala, outyielded significantly the standard varieties Festival, Koda and Charter. Koda and Charter were badly affected by both frost and stem rust. Of the late varieties, the new release HSPFSH 5016, which has been named Hopps, shared top position with Lawrence. Sabre was badly affected by both stem rust and frost.



Plate 4.—Stem-rust Infection of Wheat in the 1958 Season. The varieties from left to right are Spica, Festival, Gabo, Charter, Koda, Puora and a Puora back-cross now named Kenora.

The outstanding feature of these trials, and of the season generally, was the collapse of Gabo and Charter due to the new stem rust. As a result, these popular varieties together with Koda, Saga and others must now be removed from the recommended list.

The nitrogen fertilizer studies at Pampas were continued for the third season. As mentioned in previous reports, this area has in recent years consistently produced low-protein wheat. The experiments are concerned with the effects of time and rate of application of urea on yield, mottling, grain protein and baking quality. In general, the results confirm previous results in that applications at the early stages (sowing and tillering) produce greatest yield increases, and applications at later stages (shot-blade and flowering) produce greatest increases in grain protein.

Yields were also recorded on plots which had received similar treatments in 1956 and 1957. On both areas, which have not received any subsequent fertilization, significant yield increases occurred on the former treatment plots independent generally of the time of application. These residual effects are noteworthy and could have an important bearing on the economics of nitrogen fertilizing in this district.

It is interesting to record that a somewhat similar trial applying nitrogen to wheat on an alluvial soil

in the Callide Valley gave no significant increases in yield from added nitrogen, although there was a slight increase in grain protein.



Plate 5.—A Plot of the Wheat Variety Kenora, Recently Bred by the Department of Agriculture and Stock.

The field wheat competition sponsored by Toowoomba's Royal Agricultural Society in co-operation with the Department of Agriculture and the State Wheat Board gave very significant results. For the first time the champion crop was grown in the brigalow belt. The variety was Spica, which yielded 47 bus. to the acre and had a grain protein content of 16 per cent. The crop was grown on virgin brigalow land and the result is a measure of the productivity of such country. The reserve championship was awarded to a crop of Lawrence grown on the open plains of the Darling Downs; this crop yielded 45 bus. to the acre and had a grain protein content of 14.3 per cent.

The competition highlighted two important points:—

(1) In entries from the brigalow belt, there is a rapid drop in grain protein content with continued cultivation. This emphasises the urgent need for adopting a balanced farming system on these soils. It is interesting to note that the mean grain protein content of entries from the brigalow belt was 15.3 per cent, while that from the open plains country was 12.4 per cent.

(2) For the third year in succession the leading crop on the Darling Downs proper has been produced following lucerne in a rotation. This year's crop (the reserve champion) had been grown in old land which had been down to lucerne for five years. The performance is all the more noteworthy because the variety sown, Lawrence, is not regarded as one with a high yield potential.

On the open plains of the Darling Downs the first year of a randomised and replicated wheat-pasture rotation trial was successfully completed. The trial is planned as an 8-year cycle to compare the effect of a grass/lucerne pasture of one, two, three or four years' duration on the yield and quality of succeeding wheat crops. The wheat variety being used is Spica, which has good inherent protein quality. The pasture plots were fenced and will be grazed by sheep. The harvesting of the first season's wheat crop has indicated that the experimental area is of satisfactory uniformity.

Other Winter Crops

For many years oats has been the principal winter grazing crop in the State and most attention has been given to providing a good grazing oat for coastal districts, where crown rust affects yield seriously. The screening of some 84 introduced varieties was carried out under quarantine conditions, and seed of the more promising varieties was forwarded to Hermitage Regional Experiment Station for further selection and testing by the plant breeding staff.

In trials conducted on the coast, the only varieties giving satisfactory grazing performance were Benton and Saia, which are both resistant to crown rust. The variety Bovah recently bred and released by the Department is now generally susceptible to a new strain of this rust.

The trials at Hermitage compared early and late varieties under grazing conditions and also took into account the fact that Darling Downs farmers are interested in a variety which will return a reasonable grain crop after three or four grazings. Of the newer early varieties, Camellia, Floriland and Saia performed well in both respects, as did also the newer late varieties Santa Fe, Trispermia and Landhafer.

A number of linseed varietal trials were completed on the Darling Downs and in none of these was the commercial strain of Walsh outyielded. In two trials at Hermitage Regional Experiment Station, comprising 11 early and nine mid-season varieties, yields were very poor, due both to frost damage and to "zinc deficiency" symptoms. The position seems to have been reached where the Station soils because of this nutritional problem are unsatisfactory for testing and evaluating linseed varieties but offer scope for nutritional investigations.

This soil disorder, which was noted in last year's report as affecting general crops, has been studied from several aspects by officers located at Toowoomba and Warwick. Linseed has been found to be a suitable indicator crop. While zinc has not been disregarded as a factor, the carbon/nitrogen ratio of the soil, soil flora and fauna, and trace elements additional to zinc are being investigated.

The problem of grain size in canary seed was studied further. Three main points have arisen from this work, which was done at Hermitage Regional Experiment Station:—

(1) Large-seeded Moroccan and Spanish strains do not retain their large seed size under Queensland conditions.

(2) Some strains do appear capable of producing larger seed than others.

(3) Local small-seeded strains usually outyield the introduced strains, particularly under adverse conditions. Therefore, until the industry is prepared to pay an appreciable premium for seed size, the local strain must be regarded as the most suitable for this environment.

Maize

Seed of the following Queensland hybrids was produced during 1958-59 under the Department's seed certification scheme:—Q.23, Q.440, Q.462, Q.526, Q.692, Q.716, Q.724, Q.739, and Q.790.

In recent years a comprehensive series of trials has enabled the Department to make suitable recommenda-

tions of hybrids for most of the major maize districts. Two districts in which such testing is being continued are the south-eastern Darling Downs and the Atherton Tableland.

In the south-eastern Downs, growers show some preference for DS. hybrids bred on the New England Tableland of New South Wales. These generally mature earlier than Queensland hybrids. In a recent trial, the three top hybrids were DS.65A (62.8 bus. per acre), Q.790 (59.7 bus. per acre), and Q.716 (57.1 bus. per acre). However, DS.65A, which has given consistently good performances for a few years past, is not an early hybrid; it is actually later maturing than the Q hybrids with which it has been compared. The early DS. hybrids, such as DS.28, are normally lower yielding than the mid-season group of Q hybrids.

On the Atherton Tableland, where the maize has to stand up to a high incidence of cob-rots, no hybrid has yet been found with satisfactory resistance in this respect. A number of hybrids have shown a capacity to outyield the local Dent and Durum strains, but in the event of a high incidence of cob-rots this advantage may be more than lost. In last season's trial a number of Grafton hybrids significantly outyielded the local Dent strain by as much as 50 per cent., but in other years the same hybrids have failed to equal the local variety. Efforts are at present being made to locate a hybrid more particularly suited to the special conditions existing on the wetter parts of the Atherton Tableland. To this end experimental crosses from both Queensland and New South Wales are being examined. The Queensland crosses are being based on inbred lines derived from Atherton open-pollinated varieties.

Sorghum

The hybrid sorghum breeding project was advanced a stage and seed of some eight hybrids is available for testing. During the coming season these hybrids will be compared with existing commercial varieties such as Alpha, Wheatland, Early Kalo and Martin.

To assist in weed control in grain sorghum crops a hormone tolerance trial was repeated during the year. MCPA and the sodium and amine salts of 2,4-D were compared at three plant stages—3 in. high, 15 in. high and at flowering. Previous work had indicated that MCPA was the most selective of the hormones used and the sodium salt of 2,4-D the least selective; also, spraying at 3 in. high was recommended, as weed seedlings were least protected by the crop at this stage, resultant crop yields were higher and least damage to the crop was caused by the spraying equipment. Though the past season's results were not as clear-cut, MCPA was again the most selective and the 3 in. stage gave higher yields than the other two stages. Alpha was the variety used.



Plate 6.—A Battery of Six 3,000 bus. Grain Silos on a Springsure Grazing Property. A further six silos are in an adjacent battery.

A grain storage demonstration using Alpha grain sorghum has been in progress for almost two years in the Central Highlands. The grain is stored in two 500-bus. steel silos and a close check is kept on grain temperature, grain moisture content and insect infestation. Apart from some small losses occasioned when the silos were unroofed in a violent wind storm, the grain has not lost in appearance and quality. The demonstration has encouraged a number of local farmers to store grain in a similar manner.

Tobacco

Further expansion of Branch work was achieved with money made available from the Tobacco Industry Trust Account.

The main development during the year was at the Parada Tobacco Experiment Station, where a machinery shed and quarters for technical staff were erected. It is hoped that the end of the coming year will see the virtual completion of the building and development programme at Parada. This is being made possible by the generous assistance of the Irrigation and Water Supply Commission in the provision of buildings, clearing and fencing. Plans have also been drawn up for the erection of an office-laboratory block at the Inglewood Station.

In a tobacco varietal trial, two of the nine varieties, Mammoth Delcrest and Special Virginia, both yielded over 2,000 lb. of graded leaf per acre. The leaf of the latter variety is of particularly good quality. Facilities have also been provided at Parada for pest and disease investigations by other Branches. Three tobacco hybrids tested show good resistance to blue mould while retaining an attractive appearance.

During the year exploratory plantings of maize, peanuts and cotton were made to investigate the agronomic potential of four soil types at Parada and a fifth type outside the Station area. Results to date indicate that these crops can be grown satisfactorily under irrigation provided adequate fertilizer is supplied.

Investigations at Inglewood at present include rotation and varietal trials, while observation plots were laid down in connection with the problems associated with excess chlorine in tobacco leaf. One plot was on an

area of tile drainage installed by the Irrigation and Water Supply Commission, which will be sufficiently stable to provide detailed experimental evidence during the coming season. A heavy incidence of blue mould coupled with cyclonic winds caused considerable damage to all experimental areas on the Inglewood Station during the past season.

Cotton

Emphasis has been placed on this crop as part of a suitable rotation on tobacco farms. Very satisfactory results have been obtained in the Mareeba-Dimbulah and south-west tobacco areas under irrigation. On experimental plots at the Inglewood Tobacco Experiment Station, varietal yields of over 3,000 lb. of seed cotton per acre were recorded. Some newer varieties, notably Lankart and Bobshaw, showed considerable promise.



Plate 8.—Furrow Irrigating for Cotton on the St. George Irrigation Area.

A 50-acre cotton demonstration area was conducted on the St. George Irrigation area. In addition, a number of plots were established to test varieties, fertilizer applications and desirable irrigation practices.

From this year's activities the following points emerged:—

- (1) In southern Queensland particularly, the importance of early land preparation and early (October) planting has been highlighted.
- (2) Cotton appears to be a most suitable irrigated crop for tobacco farms in the Inglewood area, as well as for St. George and other districts in the south-west.
- (3) There appears to be scope for use of nitrogen fertilizers in cotton production, particularly under irrigation.
- (4) Some further study of planting rates should be made with a view to increasing stands.
- (5) It will be necessary to adopt varieties and cultural practices suited to mechanical harvesting.

Potatoes

The varietal position in the potato industry has remained steady for the past few seasons, with Sebago occupying about 80 per cent. of plantings in the Lockyer, the main potato-growing district. Sequoia, Kernebec and Exton are the only other varieties being grown on a commercial scale. Sebago has held its place as the favoured variety because of its high-yielding capacity, its good shape and size and its general freedom from scab.



Plate 7.—Mammoth Delcrest Tobacco on Inglewood Tobacco Experiment Station.

In a varietal trial on the Atherton Tableland Sequoia significantly outyielded Sebago and Kennebec. Using this variety and applying a mixed fertilizer (of approximate composition 5:14:5) at 1 ton per acre a farmer at Kaban obtained a yield of 23 tons to the acre under irrigation.

Arrangements have been made with the New South Wales Department of Agriculture for new seedling potatoes produced by its plant breeding section at Glen Innes to be tested in Queensland.

Peanuts

Trials carried out over a 3-year period at Kingaroy have brought to light two peanut introductions of Virginia Bunch type which outyielded the local commercial strain. They are, however, later in maturity, and under less favourable seasonal conditions yields would be expected to decline. One of these strains, Mani Pintar, has a red-and-white striped seed coat.

Over the same period on scrub soils, some "White" Spanish types consistently outyielded the local Red Spanish variety. It has yet to be determined whether the light-coloured kernel of the former would be a disadvantage commercially.



Plate 9.—Portion of an Onion Weedicide Trial in the Lockyer Valley.

Weed Control and Weedicides

The testing of some of the newer weedicides for weed control in onions was continued during the year. Best control was again achieved by CMU applied as a pre-emergence application at 1 lb. to the acre. Of interest was the performance of chloro-IPC, which for the first time gave some weed control.

In peanuts both pre-emergence and post-emergence applications of well-known weedicides have been studied. Results confirm previous trials that hormones are effective pre-emergence weedicides but that considerable care is required in their use on this crop as post-emergence applications. Virginia Bunch appears more susceptible than Red Spanish and reduced yields are likely at rates of application exceeding 3 oz. acid equivalent per acre.

Exploratory trials for the control of guava have been completed and best control was achieved with a 2½ per cent. solution of 2,4,5-T as a basal spray. Spraying young growth with 0.1 per cent. solutions of 2,4,5-T also gave some control and further tests are proposed.

In a Charleville district trial, buffel grass gave 100 per cent. survival following severe drought and overgrazing while only 25 per cent. of the green panic plants survived and all the Rhodes grass died. Of the commercial strains of buffel grass, American buffel has given best establishment and quickest natural spread in some mid-western plots.

The study of native pastures on the Central Highlands and in the Central-West, with particular reference to native legumes, the blue grasses and black spear grass, continued.

Pasture Seed Production

The lack of adequate seed supplies is limiting the wider use of certain proven species but the position is gradually improving. Seed of centro, phasey bean and scrobic is now being harvested mechanically on a small scale in Queensland. Seed supplies of stylo and *Glycine javanica* are, however, urgently needed; mother seed stocks are being built up in order to provide a nucleus for commercial seed production areas.

AGROSTOLOGY

A total of 376 pasture investigations of varying size and complexity has been in train during the year. A number of these trials were financed by funds from the Australian Dairy Produce Board, the Australian Meat Board, the Wool Research Fund and Shell Chemical (Aust.) Pty. Ltd.

Pasture Species

Species and strains of grasses and legumes numbering 221 were received for testing under quarantine conditions during the year.

The legumes centro, stylo, Townsville lucerne, *Glycine javanica*, *Desmodium uncinatum* and lucerne have continued to show promise over a wide range of conditions.

Pangola grass (*Digitaria decumbens*) obtained from C.S.I.R.O. is showing ability to compete with weeds and to make vigorous growth in the Innisfail area.



Plate 10.—Harvesting Buffel Grass Seed With a Commercial Harvester in the Central Burnett.



Plate 11.—Harvesting Buffel Grass Seed for Station Sowing in the North-west.

The buffel grass seed supply position can now be regarded as satisfactory and prices of this grass seed should fall in the future. Factors affecting the seed production of a number of other promising species are being studied on various experiment stations.

Pasture Yield and Protein Trials

Several pasture mixtures have been sampled for yields and protein levels with interesting results.

Guinea grass-centro mixtures established in the Mackay district yielded 23.3 tons of green matter per acre during the year while ungrazed native pastures produced only 7.8 tons. At Innisfail, guinea grass and molasses grass grown with centro but analysed without the legume had protein levels of 12.6 and 9.1 per cent. respectively. When grown without the legume the grasses yielded only 9.5 and 7.1 per cent. of protein respectively.

Trial mixtures of molasses grass with centro and stylo sown in January 1958 on frost-free hilltops near Currumbin have competed well with blady grass. After five months the stylo yielded 23 cwt. of air-dry hay per acre while the centro produced 7 cwt. of legume hay. After grazing during the early summer the area was

spelled until April 1959, when stylo and centro mixtures gave approximately 5 tons and 6 tons of air-dry hay respectively. In addition, the stylo had spread up to 100 ft. from the plot site.

Fertilizer Trials

Fertilizer trials were continued. The pattern of results has been the familiar one of response to superphosphate by clovers on the poorer coastal soils and by buffel grass on some of the poorer soils of the inland. In addition, responses to applied nitrogen have been marked in coastal districts.

On dark grey peaty loam soils at Currumbin Creek a white clover and red clover pasture gave significantly increased yields when 4 cwt. of superphosphate was applied with borax at 14 lb. per acre. At Ormeau on a grey brown clay loam typical of the forest soils in the Beenleigh country, highly significant increases in clover yield were also obtained from the use of superphosphate at 4 cwt. per acre.

The use of 3 cwt. of nitrate of soda per acre in July on high-phosphate, grey-brown loamy sand at Moggill gave a highly significant increase in yield of 2 tons of green material per acre from an old lucerne stand normally showing poor winter and spring production.

Interesting results have also been obtained from a grazing trial at Cooran on an old paspalum and mat grass pasture which is devoid of legumes. A nitrogen-phosphate fertilizer was compared with phosphate alone. Following the commencement of grazing in June 1958, the paddocks were top-dressed in early summer 1958. The area receiving $2\frac{1}{2}$ cwt. sulphate of ammonia and 3 cwt. superphosphate per acre provided 37 per cent. more grazing than the paddocks receiving only 3 cwt. superphosphate.

A trial comparing three levels of nitrogen, potash and sulphur on an irrigated pasture on a high-phosphate black soil at Glengallan gave highly significant responses to nitrogen within eight weeks. This response diminished during the year but an increasing and highly significant response to potash was recorded.

Two pot trials with different western soils, using Biloela buffel grass as the indicator plant, were conducted during the year. One trial examined a red sandy clay loam associated with box and mulga. Marked initial response to phosphate was shown but plants receiving no phosphate later equalled the treated plants in height and there were no significant differences in final yield. The growth curves are shown in Plate 12.

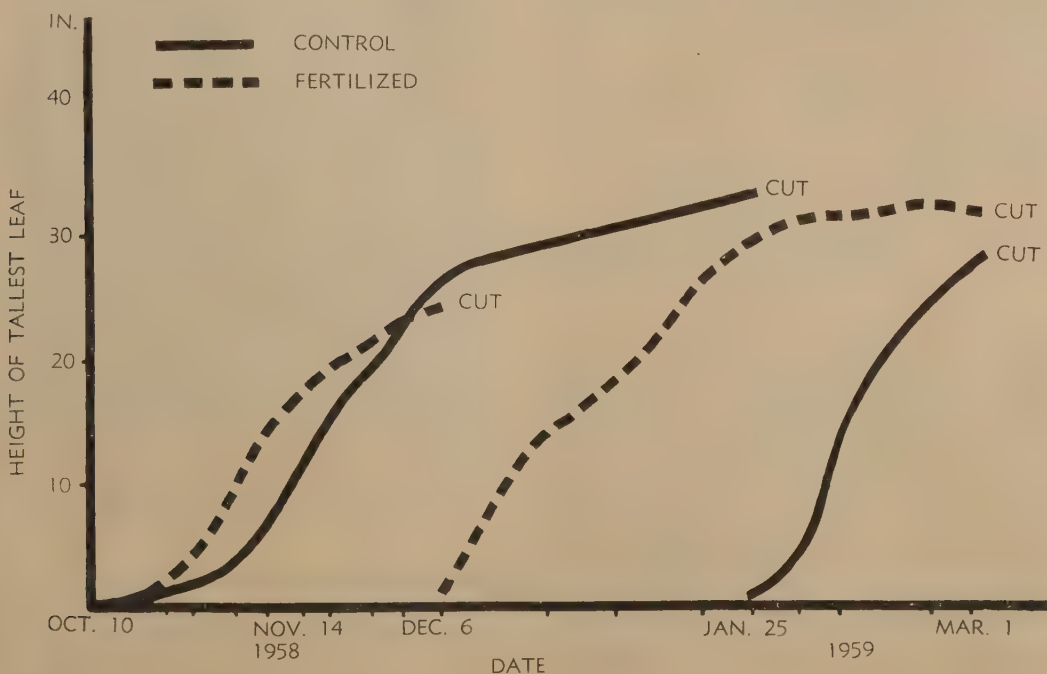


Plate 12.—Growth Curves of Buffel Grass Fertilized and Unfertilized on Red Sandy Clay Loam.

The second trial, with a sand-ridge cypress pine soil, indicated an acute deficiency of both phosphorus and nitrogen. Responses to the combination of nitrogen and phosphate were spectacular (Table 1). In this trial no tendency for untreated plants to overtake those receiving fertilizer was observed.

TABLE 1

YIELD OF BILOELA BUFFEL IN CYPRESS PINE SANDRIDGE SOIL

Fertilizer	Yield (gm./pot)
N- P-	0.65
N+ P-	0.91
N- P+	1.59
N+ P+	7.29

- indicates No fertilizer + indicates fertilizer added
N = nitrogen P = phosphate

Fertilizer responses to phosphate have also been recorded for phasey bean in the Gin Gin area, and for lucerne on sandy soils in the Eidsvold area, where possible responses to molybdenum and potash have also been reported. At Bullyard, near Bundaberg, a residual response to superphosphate in the sixth year following treatment has been recorded.

Pasture Establishment

The most detailed establishment investigations are concerned with the black earths of the Darling Downs. Initial studies have demonstrated the controlling influence of microclimate. Techniques have been developed to use thermistors to measure soil temperatures close to the surface. Surface temperatures up to 67 deg. C. have been recorded.

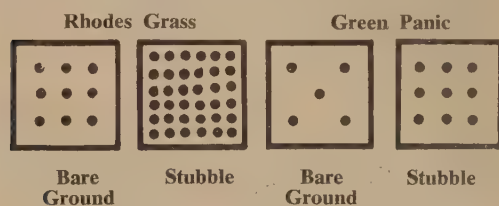


Plate 13.—Effect of Wheat Stubble on Pasture Establishment. Each dot represents one seedling and each square 1 sq. yd.

The critical effect of microclimate is to be seen in the results of trials conducted on 10 farms, to study the effect of wheat stubble covers on the establishment of Rhodes grass and green panic. Stubble covers averaging 2,200 lb. per acre produced marked increases in seedling density as shown in Plate 13. Standing stubble gave higher yields than mown stubble, due possibly to a differential effect on the microclimate (Table 2). Further study of the problem is planned.

TABLE 2

COMPARISON OF STANDING STUBBLE AND MOWN STUBBLE ON GRASS ESTABLISHMENT, OPEN PLAINS SOILS, DARLING DOWNS

	Rhodes		Green Panic	
	Seedlings /sq. yd.	Mean Plant Wt. (g.)	Seedlings /sq. yd.	Mean Plant Wt. (g.)
Standing Stubble ..	40.5	3.3	5.7	3.2
Mown Stubble ..	35.8	2.1	8.6	0.9

Nurseries are being established on a small sward basis, and grazing animals are being employed. In view of establishment difficulties, most summer species are planted as clonal material from plants raised under irrigation.

The germination of Rhodes grass, green panic and *Dichanthium* sp. is being studied under different regimens of temperature, moisture and depth of planting.

"Brian Pastures" Research Station

Work on this station has expanded during the year and increased attention is being given to fundamental research on pasture management. Some 32 pasture projects are in progress.

The major grazing trial, comparing Rhodes grass, green panic and buffel, each sown with lucerne and phasey bean, was continued. This trial was maintained at its normal stocking rate of 1 beast to 2½ acres during the drought. Changes in botanical composition resulted from this drastic treatment. Lucerne declined in the buffel and green panic paddocks and many Rhodes grass plants died. Liveweight gains per acre were still superior to those recorded from native pastures. From August 1958 to May 1959 buffel grass produced 107 lb. liveweight per acre, Rhodes grass 105 lb. and green panic 99 lb., while native grass yielded only 56 lb. of liveweight with similar animals.

Substantial changes have been recorded in stock growth and botanical composition in the native pasture management trial. The treatments are (a) rotational grazing; (b) an intensive system of management involving deferred grazing and slashing of surface growth; (c) chisel plough renovation; (d) supplementary winter lucerne grazing; and (e) continuous grazing. Treatments (a) and (b) have shown to a slight disadvantage in animal weight gains so far (Table 3), but these treatments appear to be favouring the dominance of forest blue grass over black spear grass.

TABLE 3

ANIMAL LIVEWEIGHT CHANGES ON NATIVE PASTURES UNDER DIFFERENT SYSTEMS OF MANAGEMENT (Stocking rate 1 beast to 6 acres)

Period	30-1-58 to 20-11-58	21-11-58 to 21-5-59
	lb. per head	lb. per head
Rotational grazing	342 ± 16.5	172 ± 11.7
Intensive system	318 ± 22.3	196 ± 11.4
Control (open grazing) ..	372 ± 16.2	206 ± 7.2
Chisel renovation	426 ± 17.0	209 ± 6.7
Supplementary winter lucerne	444 ± 12.4	184 ± 15.3

A preliminary study of the effect of spring burning on the regrowth of native pastures showed that burnt plots had produced only one-third as much green material as the unburnt area one month after treatment.

Improved success was obtained in the establishment of lucerne in native pastures by sowing in late autumn following a burn and a single cultivation.

The March application of nitrogen and sulphur to old green panic pastures growing on self-mulching soils of basaltic origin substantially increased yields.

Distinct differences in yields have been recorded between strains of buffel grass in the small plots. Various panics such as Makarikari grass exhibit superior winter performance to the buffels.

A series of growth and development studies is providing basic information on the causes of variations in yield due to management or genetic differences.

Large differences in root weight have occurred as a result of different frequencies of mowing. Buffel grass has yielded heavier root weights but green panic has a higher percentage of the plant's weight in the stems.

Some growth attributes of grass seedlings were measured in the late summers of 1958 and 1959. In both years the growth of shoots and roots could be described by the same form of mathematical equation. The ratio of the relative growth rates of roots and shoots was constant, identical for both years, and independent of the onset of flowering.

Further trials of herbicides on the control of bloodwood regrowth have been made using 2, 4, 5-T butyl ester in diesel distillate. Concentrations of 2 and 3 per cent. have been more effective than 1 per cent. Spring or early summer treatments have been more efficient than treatment during the dormant winter period; and the best methods of application have been to pour the solution into the frills or into holes at the base of the trees, as close to ground level as possible.

Irrigated Pastures

Irrigated pasture investigations have been continued in the Mareeba area. Of the tropical irrigated pasture species, para grass, guinea grass and the legumes centro and puero have proved most productive. Puero combined well with common guinea to make a pasture similar to the common guinea-centro mixture giving

approximately 340 cow-days per acre per annum. Stylo or glycine with common guinea grass was not as productive as centro or puero. Centro was the most effective nitrogen-fixing legume.



Plate 14.—Trial Pasture Mixtures at Parada Tobacco Experiment Station. Common guinea grass and stylo in foreground; common guinea grass and puero at back.



Plate 15.—An Exploratory Irrigated Area of Paspalum and Irrigation White Clover at Parada Tobacco Experiment Station.

Temperate and subtropical species were highly productive in the cooler months at Mareeba but were unsuited for survival in the summer months. Of the grasses, paspalum was the best and the combination of this grass with Ladino clover, Irrigation white clover and centro is to be investigated further. A proportion of irrigated pasture of the paspalum/clover type might well prove profitable in this tropical zone to help provide year-round quality grazing.

SOIL CONSERVATION

Progress made in soil conservation work significantly outstripped that of any other 12-month period in the 12 years since a Soil Conservation Section was established in the Department.

Over 1,500 landholders requested technical assistance during the year; of these, 512 had not undertaken soil conservation work previously. To meet these needs 2,893 farm visits were made by extension officers for the purposes of preparing farm plans, surveying sites for earthworks and advising on construction procedures and land-use needs.

Protective earthworks were installed on 16,500 acres of cultivated lands during the year. This all-time high makes a total of 72,000 acres of the State's cultivated lands which have now been protected by earthworks. The number of farmers applying these measures totals 2,180, which is a 30 per cent. increase on last year's figure. The main limitation to greater progress is that there are still insufficient trained staff.

A major change in planning procedures made during the year will ensure that all soil conservation work executed under Departmental supervision will be based on carefully prepared catchment plans intended to safeguard community interests. The recent establishment of District Soil Conservation Committees, with representation from interested Government Departments and Local Authorities, will result in more effective co-ordination of plans for water disposal systems.

Two Local Authorities have established Soil Conservation Sub-Committees to tie in Council activities with district soil conservation needs. Results to date suggest that these sub-committees may provide a very effective liaison between the Council and the Department's soil conservation service in such districts.

Run-off and Erosion Control

Special efforts were made during the year to consolidate planning procedures so that complete conservation plans could be finalised for all the main agricultural areas in a minimum of time.

As a result of this drive, base plans involving 550,000 acres were completed for 110 grid units, compared with 30 for the preceding year. The number of base plans now completed totals 250 grid units. Each grid unit covers 5,000 acres and provides the basic topographic and property data necessary to commence planning operations. The plans are on a scale of 10 chains to 1 inch, which gives a convenient size for drafting purposes.

The development of group soil conservation plans from these base plans is a lengthy and complex technical operation involving more than 30 man-days per grid unit.

These soil conservation plans show the location and size of all necessary protective earthworks. This work was completed for 10 grid units during the year, making an overall total of 24. Extension officers, using these plans, provide the surveying service for the location of these structures in the field.

The area of cultivated land protected by earthworks during the year exceeded the previous year's record figure by 3,500 acres, an increase of nearly 30 per cent. The main increase occurred in the Burnett zone, where 8,644 acres were treated, compared with 5,200 acres for 1957-58. On the Darling Downs 6,989 acres were treated, compared with 6,760 acres for 1957-58.

Although availability of finance was an important factor, the marked increase in the Burnett total can be attributed mainly to the stimulation of farmer interest through the advance planning of catchments in that district. Whereas 481 Burnett landholders applied for assistance in 1957-58, the number increased to 698 in the year under review. On the Darling Downs, where catchment planning is only commencing, there were 694 requests for assistance in 1957-58 and 616 in 1958-59.

Catchment Projects

During the year field planning was completed on the 18,000 acre Rocky Creek catchment area near Pittsworth. Design calculations have been prepared for about two-thirds of the catchment and the scheme will be ready for release in the coming year. Here again, Departmental contact with landholders in the course of preparing the plan stimulated a considerable amount of interest. As a result, nearly 50 per cent. of the farmers in the catchment have now taken steps to initiate soil conservation work.

Planning of the 14,000 acre Missen's Flat catchment near Clifton was also commenced and the interest of farmers has again been stimulated in this area. Planning of the Inverlaw catchment in the South Burnett district was also commenced and is well advanced.

Progress in the catchment soil conservation scheme at Atherton has been disappointing. All water disposal systems were constructed under the direction of the

Atherton Shire Council over 12 months ago, but the rate of construction by farmers of complementary contour bank systems has been much slower than expected.

Extension Activities

Mass media have been used where possible to arouse interest and to outline the general principles of soil conservation work. During the year 39 radio talks were given and 40 press articles released.

Twenty field days and schools were conducted and 3 inspection tours were arranged. Two Show displays were prepared and 50 lectures delivered. Five articles were published in the *Queensland Agricultural Journal*.

There is increasing evidence this year that the advance planning of the farms of landholders previously not interested in soil conservation work is a most profitable method of stimulating interest and action. The farm visit, which is an essential feature of advance planning, is still the most effective means of extension in soil conservation.

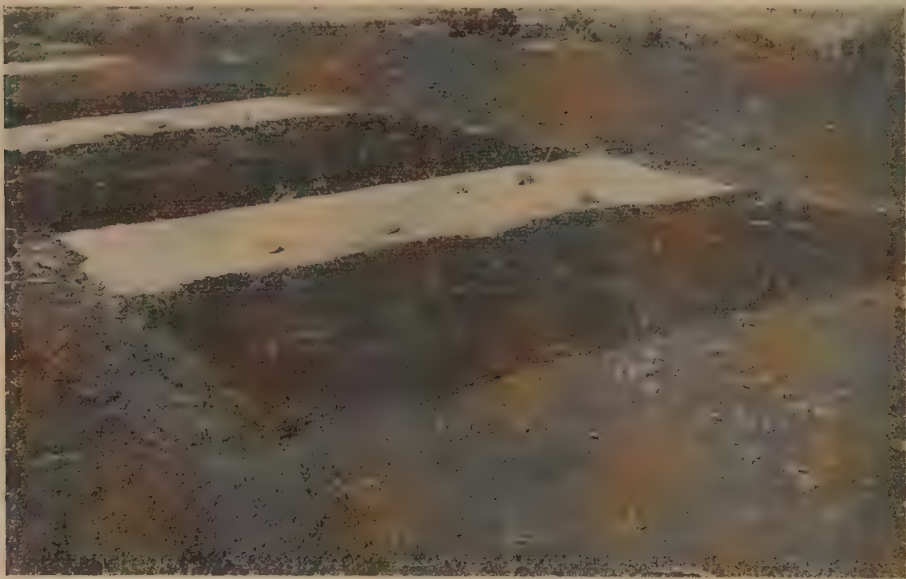


Plate 16.—Kikuyu Grass Surfacing Trial at Pittsworth. The plots are surfaced with asphalt, plastic sheeting, and mulch and asphalt. An untreated plot is in the foreground.



Plate 17.—General View of Kikuyu Grass Planting Trial on a Waterway at Pittsworth.

Investigations

Owing to shortage of research staff these activities have been confined mainly to the Darling Downs area. The investigations there have centred on methods of establishing kikuyu grass for the purpose of stabilising waterways and gullied areas.

Planting trials conducted at intervals throughout the 12-month period showed that the most satisfactory establishment results from a planting depth of 2-4 in., and that planting at a depth of 6 in. has a deleterious effect on establishment. The percentage of effective strike and rate of colonisation increased in proportion to the length of runner planted.

Trials to determine the most suitable planting times and the best materials for surface protection also provided conclusive results. Late winter planting provided very satisfactory establishment where an aqueous asphalt emulsion at the rate of $\frac{3}{4}$ -1½ gal. per sq. yard was used for surface treatment. Increase in soil temperature appeared to be the important factor, as the response to such treatment was less in summer plantings. Colonisation was less satisfactory under a vegetative mulch cover, with or without emulsion, or where the area did not receive any surface protection.

Waterway fertilizer observations carried out in the Pittsworth district have indicated that no appreciable increase in the kikuyu grass colonisation rate is obtained from fertilizer application at time of planting. In trials on established waterways, however, the application of nitrogen did give a spectacular improvement in the density of ground cover.

Near Petrie a trial was initiated three years ago to determine the value of contour and keyline ripping procedures for the establishment and maintenance of pasture. This trial, now concluded, has shown that (1) there is little difference in productivity between contour and keyline ripping, and (2) there is no particular advantage to be gained in ripping pastures on this soil type within three years after establishment.

AGRICULTURAL MACHINERY

The improvement in the supply of agricultural machinery, fencing and building materials continued and with the exception of temporary delays in some areas due to shipping, the requirements of primary producers throughout the year were adequately met. The fall in wool prices adversely affected the sale of machinery and materials, but with the recent upward price trend the demand for all secondary products has improved.

There was a good demand throughout the State for fodder conservation equipment, particularly forage harvesters. The anticipated reduction in the capital cost of these machines has materialized owing to increasing competition between Australian manufacturers producing such equipment. Further mechanization of the handling of green forage and silage has taken place by the introduction of power boxes. These automatically unload green feed or silage into feeding troughs or along fences for paddock feeding. The extraction of silage from trench silos, which has hitherto been slow and laborious, has now been accelerated by the availability of power operated silage extractors. These machines are capable of cutting the silage on a clean face and blowing it to a height of 10-12 ft. into a wagon or truck.

Modifications were made to the design of the Bermuda sprig planter to render it more suitable for planting grass cuttings or runners under Queensland conditions. These modifications were embodied in a prototype machine built in Toowoomba for the Department. As a result of these alterations in design, the efficiency and versatility of the machine have been appreciably increased. This prototype machine has now been given a thorough testing on the heavy clay soils of the Darling Downs, where it has been used for the establishment of kikuyu and African star grasses in soil conservation waterways. Enquiries have recently been received from overseas for details of the modified machine.

SOUTH JOHNSTONE EXPERIMENT STATION

The total rainfall during the year was above the average of 157 in., but included six months of exceptionally dry weather in the second half of 1958.

Pastures

Rotational grazing is being compared with continuous grazing in two trials. In the trial on the main area of the Station, the plots of guinea grass, para grass and centro are not yet uniform, and establishment was poor in the paddocks set aside for rotational grazing. Weight gains to date do not therefore provide a reliable comparison between treatments.

Similar comparisons are being made on 32 acres of guinea grass and centro at the Utchee Creek Sub-station. In three months during the wet season the continuous grazing was more productive at 97 lb. liveweight gain per acre than rotational grazing (one week in four) at 82 lb. per acre. These figures must be accepted with caution, however, as the cattle were quite young and unused to handling.

The trial of different pasture mixtures under continuous grazing at Utchee Creek confirmed the previous finding that the guinea grass-centro mixture was better than any other under the conditions there. The six months of dry weather reduced the overall productivity of all mixtures by approximately 14 per cent. compared with the previous year. There are indications that the para grass-centro mixture may be even more productive than guinea grass-centro during very wet weather.

The palatability and productivity of *Brachiaria decumbens*, *Digitaria decumbens* (pangola grass) and a tall succulent strain of *Panicum maximum* (Hamil grass) were compared in a small trial at the main Station. Pangola grass, with a requirement of 0.56 acre per beast, was twice as productive as Hamil grass at 1.11 acres per beast. *Brachiaria decumbens*, though apparently less palatable than the others, was intermediate in productivity. The capacity of *B. decumbens* to suppress other grasses and weeds was confirmed. These results must be accepted as preliminary only but they do indicate the potential value of pangola grass for grazing under wet tropical conditions.

Tea

The tea seed garden was maintained. To facilitate seed collection a short lawn-like grass is being established under the seed bearers in place of the old system of clean chipping. The hedge-planted areas previously cropped were maintained in production throughout most of the year. All have now been pruned heavily in order to have full-length hedges in production as from next January. Yields of prepared tea in the three years of production from the first hedges have been at 3,403 lb., 2,614 lb., and (in 1958-59) 2,241 lb. per acre. The prolonged hot dry weather from July till December reduced the yield during the year under review.

Miscellaneous

Plant museum plots have been maintained for the preliminary examination of new introductions. Several varieties of rice were grown under quarantine and some were selected for further trial.

Weed control investigations showed that old lantana may be killed by basal bark applications of 2,4-D or paraffins, and new regrowth by 2,4-D sprays. Guavas are controlled by spraying 2,4,5-T on 12 in. high regrowth from brushed plants. Experiments with these and other weeds are being continued.

Two of the major pasture pests have been giant guinea grass and giant sensitive plant (*Mimosa invisa*). The former is very difficult to control in pastures where the common strain of the same species (*Panicum maximum*) is a major component. Some measure of suppression may be achieved by frequent high mowing. *M. invisa* is controlled by spot spraying with 2,4-D and hand-pulling isolated small plants as and when discovered.

HORTICULTURE BRANCH

During the year under review many investigations covering a wide range of fruits and vegetables grown in Queensland and embracing both field and laboratory experiments were conducted by horticultural officers. The extension staff on production and distribution problems has been very active, while regulatory services embodying State and Commonwealth legislation have been intensified to cope with the larger volume of exported and imported goods.

In fruit crops perhaps the most important findings were with pineapples, where new fertilizer schedules have given a greater tonnage per acre and graded planting material has spread the crop more effectively. Another development of commercial interest emerged from time-of-planting trials in strawberries; planting during the first two weeks of March is essential for maximum yields and early cropping.

In vegetable crops the initiation of work on culinary beans and processing types of vegetables is an important development.

In the field of processing and preservation, the erection of a food preservation laboratory at Hamilton will provide essential laboratory space and equipment for work on crop utilization, which is an important feature of Branch activities.

RESEARCH PROJECTS

Pineapples

Nutritional investigations continue to produce worthwhile results. Since it was established that additional potassium was needed for optimum plant growth, new fertilizer schedules have been introduced with satisfactory results. It appears that a 10:2:20 fertilizer mixture will replace the conventional 10:6:10 mixture.

Experimental work suggests that fertilizer costs can be substantially reduced by applying the potassium and phosphorus requirements of the crop in a pre-planting dressing, that the nitrogen requirements of the plant prior to flower induction can be halved and that urea sprays applied at intervals of six weeks can replace the sulphate of ammonia normally used. A nutritional programme of this kind could cut fertilizer costs for labour and materials substantially.

Three years ago, a spacing trial indicated that plants established at 9 in. in the row as compared with the usual 12 in. increased yields per acre by approximately 30 per cent. A second trial has confirmed these results. Many growers have already adopted the closer spacing, which should soon become an established practice generally.

A detailed comparison of growth behaviour in different types of planting material has shown clearly that the larger the planting material, the earlier the flowering and the time of fruit harvesting. Fruit weight was not affected. These results leave no doubt that block planting of graded material on the farm is an effective method of spreading the crop and making the best use of the labour force available to the grower.

Controlled time of planting could be of considerable importance to growers in North Queensland. In trials at the Ayr Regional Experiment Station, it has been shown that a cropping programme based on a winter plant crop and a spring ratoon crop is practicable. Such a programme makes it possible to harvest the two crops within 32 months from planting, which is much less than the normal period for the crop cycle.

A survey of pH readings of pineapples canned at Northgate has shown that the pH is very high during early February but gradually decreases in later months. Similar results have been reported for the North Queensland summer crop, where values higher than those recorded for southern Queensland have been found in fruit harvested in December. The high pH can cause trouble in canning.

Pineapples from some districts have proved difficult to process because of their soft texture, and methods of determining texture are now under investigation.

Bananas

Detailed observations over a period of years have provided valuable information on the growth characteristics of the banana plant. This is now being exploited in field trials. Variability in planting material has a marked effect on vegetative growth, times of fruiting and yield. Such differences have an adverse effect on experimental work and are being overcome by building up clones from selected plants in each of three main varieties, Cavendish, Mons Mari and Lady Finger, and by the use of bit planting material from plants of known age.

Spacing trials indicate that the standard spacing for the Cavendish banana can be reduced from 9 x 9 ft. to 6 x 6 ft., resulting in a substantial increase in yield per acre from the plant crop. Current work is concerned with the effect of such close spacing on sucker production and the rate of development in the follower set for the ratoon crop.

Fertilizer trials have been established at Maroochy Experiment Station to determine the optimum levels of nitrogen, phosphorus and potassium. Apart from the experimentally demonstrated fact that the whole of the nutrients required by the banana plant must be applied during the first six months of growth, current fertilizer practice is somewhat empirical. The present trial should do much to establish quantitative requirements for the major nutrients.

Trials with the newer selective weedicides in bananas indicate that the sodium arsenite at present used in the majority of plantations will remain in service for some time yet. Alternatives such as PCP, dalapon and CMU have been investigated but results have been variable.

Nutrient deficiencies in banana plantations in North Queensland may be associated with certain abnormalities in growth. Spectacular responses have been obtained from magnesium applied either as a spray or as a soil dressing to plants showing symptoms of stunting and leaf chlorosis. Some other abnormalities may, however, be due to multiple deficiencies, the precise nature of which has not yet been determined.

Earlier investigations showed that dipping bananas in 2,4-dichlorophenol and 2,4-dinitrophenol retarded ripening. Subsequent tests have been inconclusive because no accurate method of determining maturity could be obtained. Changes in respiration rate are now being used as a criterion of maturity. Enquiries are received from time to time as to whether bananas can be exported but little information has been available on the cool storage life of bananas. Recent tests have shown that banana hands can be kept for three weeks at 55 deg. F. and then ripened satisfactorily. Further trials are in progress to determine whether dipping the fruit in wax emulsions will give a longer storage life.

Papaws

Papaw investigations have been concerned mainly with plant improvement projects.

Selections from Sunnysbank and Brookfield material have been purified for three generations at the Redlands Experiment Station and the lines now in production are considerably ahead of the strains grown commercially. Seed from five selections with similar characteristics will be released for district trials next year.

Hybrid No. 5, which was released in 1958 for commercial production in southern Queensland, has considerable climatic adaptability and its performance in commercial plantations has so far measured up to expectations. This variety, like other southern strains, is of doubtful value in the tropics, and a papaw improvement programme at the Kamerunga Experiment Station is therefore developing on similar lines to that in the southern areas.

Fertilizer trials in the papaw crop have seldom supplied much information, mainly because of variability in plot yields. The last such trial indicated a response to nitrogen but not to phosphorus and potassium. A further trial was established during the past year with larger plots in an attempt to obtain more critical results.

Following a visit to Queensland by an officer of the Victorian Department of Agriculture, experimental consignments of papaws were forwarded to Melbourne to determine whether winter papaws should be pre-ripened in Brisbane or ripened after arrival in Melbourne. The tests showed that it is more satisfactory to ripen the fruit after arrival provided the ripening temperatures are much higher than those normally used in Melbourne for ripening other fruits. In another series of experiments, dipping the fruit in hot water for 20 minutes, which is the commercial practice in Hawaii for controlling ripe rots, has been investigated with material obtained from the Redlands Experiment Station. As results have been variable, the thermal death point of the organisms responsible for ripe rots in Queensland papaws is now being determined by the Plant Pathology Section.

Because of an over-supply of canned pineapples some Queensland canneries are packing fruit salad in preference to pineapple. The main ingredients of fruit salad are pineapple and papaw, but the quality of the latter requires considerable improvement. Cannery supplies are drawn from market surpluses but special attention may have to be given to producing suitable canning types. In this respect the Guinea Gold variety from Yarwun and some strains from the Kamerunga Experiment Station have proved very satisfactory.

Citrus

The need for a balanced industry adjusted to the market outlets is a major consideration to citrus growers. For this reason, current work is concerned mainly with tree types possessing known stock-scion characteristics, cropping performance and fruit quality. Investigations of this kind are essentially long-term projects.

The mandarin improvement project at the Gatton Regional Experiment Station is approaching its climax. Of the numerous hybrids established, the greater proportion were inferior to the parental material and were culled on the initial 1957 appraisal. Further culling in

1958 and 1959 has reduced the number of types to 40 and these are to be held for a further 12 months. Tangors (orange x mandarin hybrids) are included in the selections and the data suggest that plants of this type could play an increasingly important part in the mandarin industry.

Nucellar material of the more important citrus varieties was also established at Gatton Regional Experiment Station some years ago to provide disease-free material in the event of existing sources of budwood becoming suspect owing to the spread of virus diseases. Actually, the disease position has not deteriorated to any marked extent but the project enables the investigators to assess the merits of nucellar trees and the part they may play in the citrus industry. Nucellar scion material is to be used in a projected lemon rootstock trial. Nucellar budwood plots of the more important A Grade varieties will be established in districts where budwood is normally cut to supply nursery commitments.

The pilot stock-scion trials for Washington Navel, Valencia Late and Joppa oranges, as well as Ellendale, Glen Retreat and Emperor mandarins, should be established by 1960 from trees raised in nurseries at Redlands Experiment Station and at Gayndah. Surplus material from these nurseries is to be used for observational trials in representative districts.

The volume of citrus fruits which has been exported interstate in the past has been limited because of fruit fly regulations. The position has been eased recently by the decision of some importing States and countries to accept citrus fruit provided they are kept for 14 days at 31 deg. F. prior to consignment. This cool storage treatment was tried with Ellendale mandarins grown in the Gayndah district in 1958, but mould wastage after removal to atmospheric temperatures was high in some cases. Methods of controlling mould wastage during colouring and storage by the use of either ammonia or nitrogen trichloride gas are being investigated and special equipment for this purpose has been imported by a citrus grower at Mundubbera for trials by Departmental officers.



Plate 18.—Six-year-old Avocado Trees in Rootstock Trial on Redlands Experiment Station.

Avocadoes

The stock-scion trial with avocadoes at Redlands Experiment Station continues to make good progress. The trees are now in their fifth year and most are already bearing good quality fruit.

Several of the varieties in the orchard could find a place in the Queensland industry because their harvest-

ing periods tend to give continuity of supplies for some nine months of the year. In addition to Fuerte, Anaheim and Nabal, Zutano and Edranol (early types), Rincon (a mid-season type) and Hass (a late-season type) are particularly attractive. The orchard has proved a valuable source of graft wood for nurserymen interested in propagating the avocado.

The stock position in avocados still requires clarification. The parentage of seed collected in or near a commercial orchard is doubtful and such seed cannot be used for propagation. Arrangements are therefore in train to establish grafted trees of the required stock type in isolation where cross pollination is unlikely to occur. Such trees should provide seed of known characteristics.

Further chemical and physical tests have been made on the main varieties and also on seedling types of avocados to determine suitable market standards. Only one seedling of the many tested has compared favourably in quality and percentage of edible flesh with the recognised varieties. It is of interest to note that growers are showing very little interest in seedlings and only about 3 per cent. of avocados sold on the Sydney market are seedlings. Fuerte continues to be the main variety and comprises about 84 per cent. of the total sales. The prescribed maturity standard of 15 per cent. oil for Fuerte has proved satisfactory and it seems likely that this standard will be adopted by the New South Wales and Victorian Departments. Results with other varieties indicate that 15 per cent. oil may be a satisfactory standard, but confirmatory work is necessary.

Macadamia Nuts

In the stock-scion trial with Macadamia nuts at Maroochy Experiment Station, the trees continue to make excellent growth and some have commenced to bear.

No progress can be reported on propagation studies. Seedling trees have been raised in the nursery and bearing trees selected as sources of scion wood. Various grafting methods will be tried in the coming year and information should be available as to whether the present methods can be improved.

Commercial processing of the nut is now well established and absorbs the major proportion of the crop. While the quality of the kernel is satisfactory immediately after cooking, rancidity develops if the storage period is prolonged. Although this problem is now under investigation it has been partly solved by self-service stores processing the kernels just prior to sale.

Custard Apple

Trees in the stock-scion trial with custard apples at the Redlands Experiment Station are just commencing to bear. Marked differences in growth are apparent but their significance for the industry has yet to be determined.

A new stock, the pond apple (*Anona glabra*), is under observation; the parent tree grows wild in North Queensland. Seedling trees show remarkable vigour and when used as stocks could be of value in some of the less well drained soils where custard apples are sometimes grown.

Deciduous Fruits

Results obtained from fertilizer trials in Granny Smith and Delicious apples have shown that the response to potassium reported earlier may be due to inherent differences in the experimental trees.

Exploratory investigations designed to clarify sod culture techniques continue. Projects are now being planned to determine the sod species which can be successfully established, the conditions needed to maintain them, and their value in building up soil fertility to the level required for commercial fruit production.

Stock-scion trials at Stanthorpe in grapes still leave a confused picture of stock effects on scion performance. The somewhat similar trial at Redlands Experiment Station, however, suggests that Phylloxera-resistant stock 3306 should be the preferred stock for Muscatel Hamburg, and R99 for Black Hamburg. 1202, though not a high yielding stock, gives a very fine berry colour.

Investigations on bud shedding in early varieties of peach were continued. DNCHP (dinitro orthocyclohexyl phenol) at 0.6 per cent. concentration applied prior to flowering again gave significant increases in yield. The variable results obtained in commercial practice with this material are probably associated with the severity or otherwise of low temperatures during the winter months. Effective treatment presupposes a correct estimate of climatic effects on bud shedding in the following spring.

Superficial scald is still the major problem in the long storage of Granny Smith apples. It can be overcome by picking the fruit at a fairly late stage of maturity and wrapping it in oiled paper. However, this restricts the period over which apples can be picked for storage and also limits the application of controlled atmosphere storage, which can prolong storage life by several months. Dipping the fruit in an alcoholic solution of diphenylamine (DPA) or incorporating DPA in wrapping paper has given complete control of superficial scald over a wide range of maturities and under various storage conditions. As DPA cannot be accepted until certain toxicology experiments in the U.S.A. have been completed, experiments with Granny Smith apples in Queensland have been concerned with determining if possible the nature of superficial scald and how DPA works. This has involved chemical determinations of certain organic compounds in the apple skin, the testing of many substances with a chemical structure similar to DPA, and the removal of DPA from the apple skin by chemical solvents at various stages during storage.

Experiments are also in progress to determine whether the concentration of DPA can be reduced to low levels by incorporating it in a mineral oil wrap which does control superficial scald under certain conditions. Semi-commercial experiments with Granny Smith apples stored in an atmosphere of 5 per cent. oxygen with a trace of carbon dioxide again demonstrated the effectiveness of this method in prolonging storage life. In the past, maintaining this atmosphere has proved difficult on a commercial scale but new methods of controlling it have recently been developed; commercial application now seems possible. Plastic liners, which are used quite extensively overseas for keeping certain types of fruit longer and in a less wilted condition, have been investigated with Delicious and Granny Smith apples grown in the Stanthorpe district. Although there were no significant differences in wastage between wrapped and unwrapped fruit, the appearance of the former was very much better.

Techniques have been developed for measuring the number and size of the cells in 1 cubic millimetre samples of apple tissue in order to determine whether keeping quality is related to cell size. The keeping quality of apples varies considerably from orchard to orchard, and cell size, which depends on cultural conditions, may have some bearing on this problem.

Passion Fruit

Selections are being made and tested for both agronomic characters and disease resistance in progenies from *Passiflora edulis* x *P. edulis* forma *flavicarpa*. Some with acceptable commercial quality have now been placed in regional trials in various districts.

The flowering and fruiting habits of *P. edulis*, *P. edulis* forma *flavicarpa* and their hybrid progenies show considerable differences. Variations in times of cropping could have a material effect on wastage from the virus disease known as woodiness and this phenomenon is being investigated, in conjunction with plant pathologists, at Redlands Experiment Station.

Fusarium resistant vines with a *P. edulis* forma *flavicarpa* stock and a *P. edulis* scion have been widely accepted by the passion fruit industry and are now commercially available through several nurseries.

Chemical determinations have shown that passion fruit which has fallen from the vine is much sweeter, less acid and more palatable than fruit of similar colour picked from the vine. This may be important in the commercial harvesting of the fruit. The suitability for processing of the various types of fruit now under trial at Redlands Experiment Station is being determined.

Strawberries

Trials are in progress at Redlands Experiment Station to compare the new variety Majestic produced on the North Coast with the standard variety Phenomenal. The new variety is vigorous and its fruit has a potentially better processing quality than the Phenomenal variety.

Times of planting trials have confirmed conclusions drawn from earlier exploratory work that plants established in the first two weeks of March produce substantially greater yields than plants established later. Early plantings tend to make excessive vegetative growth, with a consequent delay in fruiting, while late plantings tend to make little growth before the onset of winter. Regardless of the time of planting, all crops reached their harvesting peak in September. Plates 19 and 20 show some features of these trials.



Plate 19.—Strawberry Time-of-Planting Trial at Redlands Experiment Station. From foreground, planted late-February, planted mid-March, and planted mid-April.

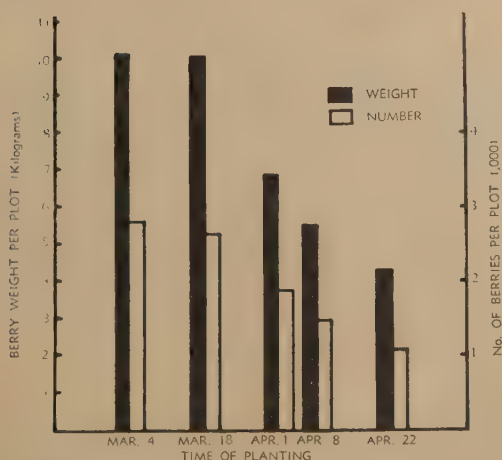


Plate 20.—Number and Weight of Berries in Strawberry Time-of-Planting Trial.

Nutritional trials carried out in mulched strawberries conjointly with the Chemical Laboratory gave significant responses to superphosphate in both basal and side dressings, and to nitrogen in side dressings. No response was obtained to added potassium. The response to superphosphate in a soil apparently adequately supplied with phosphate opens up a major horticultural problem for investigation.

Mulching trials leave little doubt that plastic mulch, in spite of its high cost, will ultimately supersede the tan bark mulch at present used by the majority of growers. Yields are increased and berry quality is comparable. Methods of using the mulch effectively, however, still require investigation.

The strawberry is the most popular quick-frozen fruit in the U.S.A., but freezing tests with the Phenomenal variety in Queensland have not been completely satisfactory, because of the fruit's soft texture. An improved product has resulted from packing the strawberries in pectin gel, which overcomes shrinkage and weeping associated with sugar and syrup packs. The gel coating also reduces loss of colour on thawing. The eight varieties imported from the U.S.A. have not proved very satisfactory, as yields have been poor, flavour weak and colour unattractive. Better results, however, may be expected when the plants become acclimatised.

Mangoes

Further investigations have been carried out to determine a satisfactory market standard for mangoes. Results confirm those of previous years—that there is a progressive increase in total solids and a progressive decrease in acidity as the fruit approaches full maturity. The total solids content is the more satisfactory index of maturity. A total solids content of not less than 15 per cent. for the Kensington Pride type and not less than 11 per cent. for the Common type has been recommended as a maturity standard. As mangoes are a prohibited entry into Victoria, the possibility of exporting them in a quick-frozen form is under investigation. Samples prepared in the laboratory have been sent to southern distributors to determine sales potential. Quick-frozen mango is rated highest among the various fruits so far frozen experimentally.

Ginger

Crystallized and cargo ginger now being produced in Queensland are regarded as high-class products because of greater attention to time of harvesting and improved processing methods. Experiments have shown that, at the time of flowering, the proportion of stringless ginger in the rhizome is almost 50 per cent. This proportion decreases at a known rate after flowering. With this information, it is now practicable for processors to control their intake in terms of rhizome quality. Laboratory experiments have been concerned with faster and less tedious crystallizing methods, and in overcoming stickiness which frequently occurs in crystallized ginger kept under humid conditions.

Tomatoes

In southern Queensland, the tomato industry is dependent on the variety Grosse Lisse, and the need for developing new types which are better adapted to cool growing conditions and less prone to disease is a paramount consideration.

The most promising winter types are the hybrids Potentate x Stokesdale and Q2 x Salads Special, but their appraisal may be complicated by the high incidence of leaf shrivel virus during the winter months at Redlands Experiment Station.

Although parental material with apparent resistance is available, efforts to develop nematode resistant lines which behave consistently in the field have proved disappointing. The inconsistent performance of selected progenies could be due to several causes, one of which is the multiplicity of nematode species in the soil. The significance of this factor is being investigated in current trials.

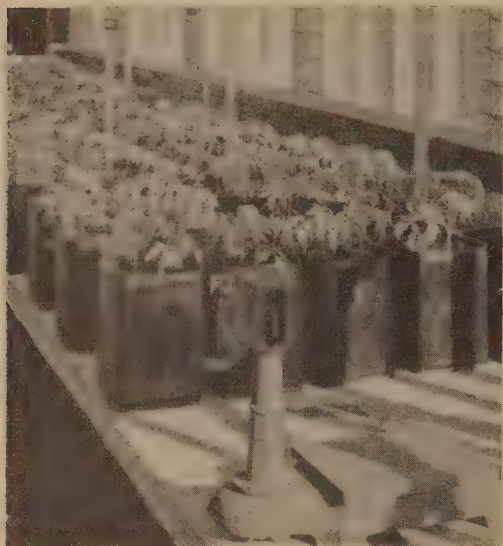


Plate 21.—Research on Tomato Nutrition Includes Trials with Plants Grown Under Controlled Conditions at Redlands Experiment Station.

Trials at Ayr Regional Experiment Station have confirmed the outstanding suitability of Q3, Lady Cunningham and Bowen Red for the dry tropics. Yields were substantially greater than those of other varieties. The trials indicated among other things that the parallel wire type of trellis is unsuitable for northern conditions.

Fertilizer trials at Stanthorpe demonstrated the need for superphosphate in tomato crops grown on virgin land with an inherently low phosphate status.

Responses to superphosphate in tomatoes grown at the Redlands Experiment Station on soils with a high phosphate content by analysis were investigated in a joint project with the Chemical Laboratory. There are indications that sulphur and zinc in the superphosphate may have a bearing on the results.

Pulse Crops

One bean improvement project which is being carried out conjointly with the Plant Pathology Branch is concerned with incorporating wider disease resistance characteristics in the recently released bean variety—Redlands Beauty.

The production of a stringless bean variety is progressing satisfactorily. Selected progenies show some segregation, but lines better adapted to local conditions than imported types should be available in about three years' time. The lack of fibre is a natural characteristic of stringless beans and makes them very susceptible to cool weather at flowering and pod setting. Under these conditions, they are rather prone to malformation of the pod. It would appear therefore that this crop must be produced under good growing conditions.

Acclimatisation studies are concerned with determining what effect time of seed production has on the composition of commercial varieties composed of several lines with different reactions to temperature and other climatic factors. The evidence to date suggests that the adaptability of commercial varieties can be materially reduced within a few generations where the seed crop is grown from year to year in one location.

High yields have been obtained in crops grown for seed in the Burdekin Delta when planted at abnormally wide spacings both in the row and between rows. At Maroochy Experiment Station, it has been shown that yields per acre are not materially affected by spacings in the row varying from 2 in. to 6 in. although plant size and number of pods per plant were considerably greater at the wider spacing.

Culinary dry beans are a potential commercial crop in North Queensland, where successful production could offset substantial imports to Australia. Steps have therefore been taken to obtain nucleus stocks of varieties and strains of commercial interest for trials at Ayr Regional Experiment Station.

The role of potassium in the nutrition of the bean plant is of considerable technical interest because depressed yields have been recorded from high-potassium fertilizers from time to time. This problem is being investigated at the Maroochy Experiment Station.

Although the pea is not an important crop in Queensland, the introduction of quick-frozen peas to the Queensland market could have some repercussions on the fresh pea trade in the near future. Few of our main agricultural areas lend themselves to the quick-frozen pea industry because of the short growing season and the relatively high disease hazards. The scope for producing this crop in the Burdekin Delta during the cooler months is therefore being investigated.

Crucifers

Little work has been done with cruciferous crops since varietal requirements of the Queensland cauliflower and cabbage industries were stabilized and optimum spacings formulated with some precision. One outstanding problem, however, is the significance of head size insofar as this is influenced by fertilizer schedules and market returns.

With the large ball-headed types of cabbage the fertilizer programme can increase head size from 3 lb. to 6 lb. at standard spacings but the market shows a preference for heads weighing 3-4 lb. On economic grounds, it would appear that fertilizer applications normally practised by growers of these varieties could be reduced.

Trials with boron and magnesium in cauliflowers have demonstrated that magnesium is a major deficiency problem in coastal areas of North Queensland. Typical symptoms in the affected plants are stunting, chlorosis of the leaves and marginal burn. Pre-planting treatment of the soil with magnesium sulphate is now recommended in these areas.

Root Crops

In the red-brown clay loams, spacings in the row of 2-3 in. had been demonstrated as being the most satisfactory spacings for commercial carrot production. The question whether these spacings are satisfactory on other soil types has been tested at Stanthorpe. Results suggest that for normal commercial production in this area a 3 in. spacing would be better than a 2 in.

Successional plantings at Redlands Experiment Station indicate that carrot varieties differ in their reactions to changing climatic conditions. The behaviour of Osborne Park and Topweight is much the same and characteristically different from that of Manchester Table, Chantenay and Danvers, and to a lesser extent, Early Short-horn. The latter group of varieties react more severely to low temperatures during the early stages of growth and development. Maximum yields in all varieties were recorded in February-March plantings, but a secondary peak occurred in late plantings which matured their crops during the spring.

A somewhat similar trial has been established during the current year, using beetroot as the test crop.

Salad Crops

In 1957, commercial crops of Pennlake, the main lettuce variety grown during the summer months in southern Queensland, exhibited considerable variability in plant type. As break-up in the plant type is a well-

known phenomenon when temperate vegetables are grown in subtropical regions, selections were made in affected commercial crops and subsequently propagated for observation at Redlands Experiment Station. All came true to the selected type. The trouble has not recurred with commercial lines of seed since and it would appear that the apparent break-up in the variety in 1957 was due to poor quality seed and not to climatic effects on the variety as such.

PROCESSING VEGETABLES

Sales of quick-frozen vegetables are increasing in Queensland, with supplies drawn from southern States. Peas and beans are the most popular vegetables, but special varieties have to be grown for processing. In peas, mechanical methods of harvesting are necessary and the pods must mature at the one time. A number of varieties of peas are being grown at the Ayr Regional Experiment Station and their suitability for freezing will be evaluated. Special equipment is being obtained to determine the correct maturity at which the peas should be harvested. Various types of culinary beans to be grown at Ayr will also be tested by the processing section. Trials with imported beans have shown that the white type of bean has a much more attractive appearance and a better flavour than the brown type.

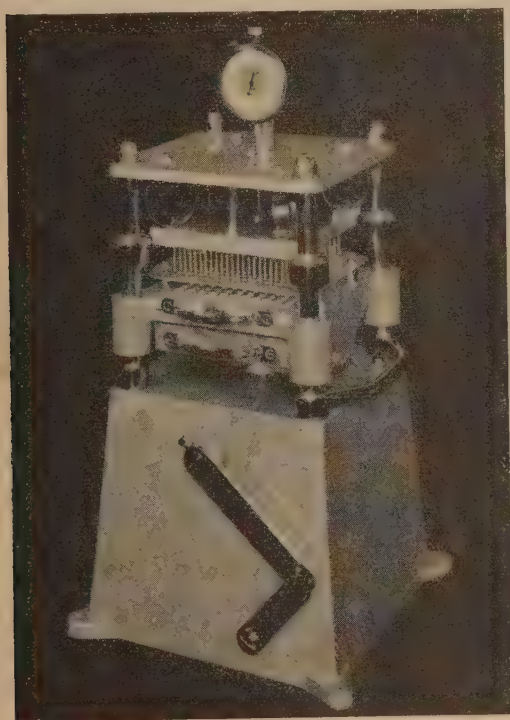


Plate 22.—Maturometer for Predicting Optimum Harvesting Time of Peas for Processing. The device measures the force required to puncture the peas.

Further work has been done on the specific gravity of potatoes, which affects both yield and texture of processed potatoes. The autumn crop of Queensland potatoes has a higher specific gravity than the spring crop, and field trials are being undertaken in conjunction with the Agriculture Branch to determine whether some varieties have a higher specific gravity than others. Considerable interest is being shown by manufacturers in the production of potato flakes, which are proving very popular in the U.S.A. because of their convenience. Equipment is now being obtained to permit commencement of processing trials on potatoes grown in Queensland.

TRANSPORT

The utilitarian value of the Preco wagon normally used for carrying hot loads of fruit and vegetables has been shown in successful and regular consignments of bottled milk from Rockhampton to Longreach and intermediate towns. The wagon has also proved very effective in

cooling milk prior to transit as the wagon can be coupled to an external power point. The condition of beans carried in louvered wagons from North Queensland to Brisbane has been compared with that of similar lots carried by fast passenger train. Because of the large quantities of beans now being grown in North Queensland during the winter months, further investigations on various methods of transport, including refrigeration, are planned for the 1959 season.

HARVESTING AND PACKAGING

In overseas countries and in southern States harvesting of apples, pears and citrus fruits into large containers has largely replaced the orthodox method of harvesting into bushel cases. In bulk handling the contents of the packing bag are discharged into bins holding 50-100 bus. of fruit which are either permanently mounted on trailers or lifted to and from flat-top tractor trailers by fork lifts or by pulley attachment. Handling costs by bulk-loading methods are estimated at 60 per cent. less than costs of handling individual cases. Bulk-handling methods are being applied successfully but on a limited scale in deciduous and citrus orchards in Queensland.

Several methods of packaging have been investigated in co-operative trials with the Victorian and Tasmanian Departments of Agriculture. Fibreboard cartons enclosed in steel crates have virtually eliminated bruising in ship transport, but the uncrated fibreboard carton has proved very satisfactory for rail and road transport of some fruits. The tray pack now being used extensively overseas has the advantage that fruit can be packed mechanically, thus reducing packing costs. This package is now being manufactured in Australia and special equipment for mechanical packing is to be installed in one of the large southern packing houses. It is anticipated that this package, which also prevents fruit bruising, will eventually prove popular in the larger fruit packing sheds.

EXPERIMENT STATIONS

Maroochy

The Maroochy Experiment Station is the main centre for research on problems affecting plantation crops such as pineapples, papaws and bananas, but investigational work is also being conducted on tree crops, such as citrus and the Macadamia nut, which are grown commercially on the North Coast.

Irrigation equipment in the citrus blocks has been improved by the installation of overhead sprinklers. Tenders are being called for the erection of a new Manager's residence. The approach to the Station's buildings has been made attractive by the planting of ornamental shrubs and trees.

Redlands

Vegetable research is the primary function of Redlands Experiment Station although some attention is given to plantation and tree crops grown commercially in the metropolitan district.

A considerable amount of developmental work has been needed during the year. Reconditioning of recently acquired land and extensions of the water reticulation mains have been major projects of this kind.

The new glasshouse supplied by the Committee of Direction of Fruit Marketing has provided very much needed facilities for plant physiology, plant breeding and associated projects. Consideration is now being given to the erection of permanent office and laboratory accommodation to replace the existing temporary premises.

During the early life of the Station, the activities of the Staff were concerned mainly with urgent short-term investigations. The current trend is towards long-term investigations on fundamental problems of plant behaviour under controlled conditions. Such work should solve some outstanding production problems encountered in commercial practice.

Kamerunga

The Kamerunga Experiment Station provides facilities for both horticultural and pathological work in North Queensland. It has operated under difficulties for some years but much of the land has now been brought back into serviceable condition and can be used effectively for plantation crops and vegetables.

A 3-year plan to effect permanent improvements to the property has been initiated. In 1958 some major items of equipment were replaced, and new buildings to house the technical and other staffs are proposed for 1959.

HAMILTON RESEARCH LABORATORY

This building, which contains laboratory, storage and processing equipment to study urgent problems on food preservation, is now nearing completion and the cold storage section should be ready for testing late in 1959. An additional area of 3 roods 3.3 perches immediately behind the building has been reserved for Departmental purposes to provide space for future expansion.

EXTENSION

Extension services followed much the same pattern as in previous years and effectively used the several publicity media available to the staff.

Advisory articles on subjects of topical interest were a regular feature in the *Queensland Agricultural Journal* published by this Department, and in *Queensland Fruit and Vegetable News*. Advisory pamphlets have been brought up to date and a new publication on principles of cool storage was issued during the year.

Eight field days were held during the year; such functions are important for promoting affiliations with grower organisations.

Group discussions with not more than 20 growers have a much greater grower appeal. They are usually restricted to a particular theme and growers themselves take a very active part, both in presenting the material and in discussing it. Such discussions are invaluable when held at experiment stations because they give growers an opportunity to see and discuss current investigations and to make their own assessment of the results achieved.

The demand for farm advisory services continues to increase. Such services are particularly important when prices for certain farm commodities are low, as at present, for production costs must be reduced to a minimum and cropping programmes may have to be adjusted.

School packing classes have been conducted in conjunction with the Department of Education at 24 schools in the Stanthorpe, Metropolitan and North Coast districts and approximately 360 students have received individual instruction. Two packing instructors from Head Office have co-operated with field officers in the Agriculture Branch in advising growers on the presentation of potatoes, onions and pumpkins for market. Condemnation of these crops is much heavier than for other fruits and vegetables. Meetings of growers have been held in the three main potato and onion districts of southern Queensland and field days are to be arranged at a later date. Suitable packing charts for these crops have been prepared for circulation to growers.

SPECIAL SERVICES

The citrus budwood and seed distribution service to nurserymen involved the collection and despatch of about 135,000 buds and 179 lb. of seed during the year. The demand for virus-free budwood for propagation on trifoliata stock still presents a problem, as local supplies of suitable material in some varieties are short. The demand for trees on orange stock continues to increase at the expense of trees on citronelle stock.

Bean seed production involved a major advisory commitment, particularly in the Burdekin, where the area under crop has expanded rapidly. Reports on crops in the full-pod stage enable the principal distributors to reserve the best available disease-free seed of approved varieties for use by the Queensland green bean industry.

Collaboration between the certified tomato seed growers at Stanthorpe and Departmental officers servicing their crops is largely responsible for the high repute in which the varieties Q2, Q3 and Q5 are held. Production in 1959-60 was lower than usual; weather conditions were far from favourable. Nevertheless, 5,900 oz. of seed were harvested.

REGULATORY

The incidence of *Phytophthora citrophthora* in nurseries caused some concern during the year. Where this disease is recorded, nurseries are not allowed to propagate citrus trees on stocks other than trifoliata.

High budding in citrus, a practice required by legislation promulgated in 1958, has now been adopted by nurserymen. The change-over from low budding to high budding involved little or no disruption to nursery management and worked trees now on hand are of a particularly high standard.

Control of bunchy top in bananas remains a major commitment of the inspectional staff. Only minor outbreaks of the disease were recorded during the year, but one of these in the Brooloo area, near the northern known limit of infection, caused some anxiety before it was brought under control. The number of diseased plants recorded was substantially below that in 1957-58 and little above the all-time low recorded in 1955. Diseased plants represent only 0.6 per cent. of the total area under crop.

EXPORT

During the year under review, Queensland exported overseas 29,604 cases of apples, 2,062 cases of pears, 3,362 cases of citrus and 10,775 cases of vegetables.

Although highest prices for apples were obtained for a February shipment of about 1,800 cases to the United Kingdom, the fruit developed bitter pit during transit. Shipments of about 24,000 cases made in March to the United Kingdom arrived in good condition and profitable prices were obtained.

The quantity of fruit exported to the United Kingdom was well below the estimates, and shipping space made available therefore exceeded requirements. In the past shipping space has been reserved by Sydney shippers, but in future Queensland shippers will be responsible for space allocation of Queensland apples.

Interstate exports of pineapples have increased by 70 per cent. following the record crop for 1959 and a marked recession in prices.

Following representations to the New South Wales Department of Agriculture, conditions of entry for potted plants have been eased and in consequence the volume of plants now being exported to southern States has increased considerably.

PLANT QUARANTINE

During the year overseas shipments entering the port of Brisbane subject to quarantine inspection comprised about 2,400 logs, 43,600 bundles of merchandise, 194,000 pieces of timber, 18,000 parcels of plants, 4,400 bags of peanuts, 3,000 bales of cotton, 3,400 bales of bamboo and thousands of wooden crates. In addition, 350 aeroplanes and over 800 ships were inspected at landing.

The handling of bulk imports has been greatly facilitated by the excellent co-operation of the Customs and Postal Departments, transport authorities and the various importers.

New regulations covering weeds and pasture seeds should provide greater safeguards against the entry of weed pests from overseas.

The plant quarantine publicity campaign sponsored by the Australian Agricultural Council is functioning satisfactorily and arrangements have been made to display posters in the various transport vehicles throughout Queensland and to screen quarantine films in commercial theatres.

REGIONAL EXPERIMENT STATIONS

The programme of activities on the Regional Experiment Stations was further expanded during the year. New crops were investigated on some Stations and on others new areas were brought into production to cope with the requirements of a widening scope of work. Investigations relate to both crops and animals and to an integration of crop and animal production for the purpose of evolving a balanced system of farming.

Although climatic conditions were fairly favourable for most of the year there were some weather vagaries that caused serious disruption of experimental programmes either by the complete destruction of crops or by having a detrimental effect on crop growth. A

severe cyclone at Ayr in mid-February destroyed experimental crops of bananas and other horticultural crops and flattened cotton crops. A rain depression resulting from this cyclone caused floods in the southern part of the State. At Hermitage Station, Swan Creek broke its banks, scoured a large area of alluvial soil and destroyed cotton and sorghum crops. Necessary reclamation work will keep this useful area out of production for a season. At Kairi Station on the Atherton Tableland a prolonged wet season caused serious rust damage to maize crops.

Rainfall data for all Stations are given in Table 1.

TABLE 1
REGIONAL EXPERIMENT STATIONS—RAINFALL, 1958-59 (INCHES)

Month	Hermitage		Biloela		Ayr		Millaroo		Kairi		Gatton	
	1958-59	Mean (13 years)	1958-59	Mean (36 years)	1958-59	Mean (10 years)	1958-59	Mean (2 years)	1958-59	Mean (6 years)	1958-59	Mean (College 60 years)
July	0.47	1.09	0.10	1.29	0.00	1.43	0.20	1.00	0.06	0.86	0.19	1.42
August	1.44	1.02	0.76	0.71	0.02	0.40	0.01	0.36	0.56	0.94	1.45	1.05
September	2.48	1.61	0.22	0.84	0.51	0.31	0.13	0.13	0.15	0.69	1.45	1.49
October	2.44	3.61	1.16	2.04	0.00	0.77	0.01	0.39	0.07	1.38	2.83	2.43
November	3.03	2.37	0.79	2.83	0.66	1.85	0.44	0.61	0.74	2.13	1.04	2.67
December	6.15	3.41	6.42	3.63	4.40	1.64	5.01	3.05	6.16	3.96	4.50	3.86
January	3.83	4.00	5.70	4.14	11.66	14.43	8.58	6.40	14.15	10.31	6.82	4.34
February	3.32	3.24	2.68	4.87	9.26	10.73	6.12	9.78	6.47	11.30	6.86	3.97
March	4.30	2.54	2.11	2.77	4.31	7.72	4.15	4.17	16.50	12.82	1.83	3.14
April	0.76	1.28	1.23	1.65	1.62	2.69	0.91	7.09	2.40	4.05	1.62	1.93
May	0.91	1.33	1.81	1.57	1.75	2.56	1.85	1.21	3.26	2.16	0.99	1.54
June	0.06	2.39	0.00	1.67	0.11	0.94	0.20	1.14	2.02	2.11	0.22	1.83
Annual Rainfall	29.19	27.89	22.98	28.06	34.30	45.47	27.61	35.33	52.54	52.71	29.80	29.69

HERMITAGE

Good planting rains in June and useful falls in August and September made soil moisture conditions satisfactory for winter crops. Growth benefits resulting from this were offset to some extent by frosts in August and September which caused serious damage to cereals, while the mild, humid conditions in October were responsible for severe leaf and stem rust infestations in susceptible varieties of cereals. Beneficial storm rains occurred throughout the summer and growing conditions for summer crops were generally favourable.

Crops

Wheat.—Yields of grain in the wheat trials were generally satisfactory. Differences in yield between varieties were largely a reflection of degrees of susceptibility to frost or rust injury.

The Puora backcross PRA₄K₁5556 (43.6 bus. per acre) performed best of the early-maturing varieties, followed by Puora (40.3 bus.), Spica (33.6), Seafoam (33.6), and Gabo (27.2). The last was virtually eliminated from the trial by the combined effects of rust and frost injury.

Another new wheat, HSPFSH-5016, topped the late-maturing varieties (41.1 bus. per acre). Others in order of yields were Lawrence (39.5), Festival (37.3), L.G.5391 (34.3) and Charter (24.4). The last was severely affected by frost. All varieties were moderately susceptible to leaf rust. HSPFSH and L.G.5391 were resistant to stem rust.

The nitrogenous fertilizer urea, sprayed onto the foliage, gave best results at 2 cwt. per acre applied at the shot blade stage (23.0 bus. per acre).

Other Cereal Crops.—Growing conditions were favourable for grain sorghum and high yields were obtained in all areas. Alpha yielded an average of 87 bus. per acre from bulk areas and 88 bus. from rotation trials. An area of Kalo is yet to be harvested.

Small areas of malting barley (Prior) and oats (Bovah) were grown mainly for pig feed.

Cotton.—As interest in cotton is developing among farmers on the Darling Downs, some trials with this crop were set out on the Station last summer. The two trials conducted gave valuable preliminary information concerning cultural aspects and potentialities of this crop on the Downs.

In a trial of standard varieties the yields of the first pick were D & PL15, 1,448 lb. of seed cotton per acre; Empire, 1,350 lb.; New Mexico Acala, 1,235 lb.; Acala 5676.10.2, 1,212 lb.; and Miller 43-9, 1,169 lb. These yields are encouraging, and with the second pick yet to be harvested, an overall yield of 1,500 lb. per acre should be obtained.

In a time-of-planting trial, four plantings were spaced over a 2-month period from early October to early December. The late plantings developed a fairly vegetative type of growth, and best yields are likely with the October plantings.

Pastures

Nursery.—Approximately 120 species of pasture grasses and legumes were maintained in the nursery for observation. In a nursery test of 12 winter grass species for production performance, palatability and ability to recover after mowing or grazing, *Phalaris tuberosa* and Priebe's prairie showed out best for recovery and bulk, while *Bromus inermis* showed outstanding out-of-season growth. Two strains of *Panicum maximum*, Q4388 and Q4389, showed promise of heavy leaf production, but no new species of winter-growing grasses appealed.

Lucerne continued to be the outstanding legume.

General.—The total area under improved pastures other than the nursery is approximately 60 acres.

Production of summer pastures was good and more feed was available than could be utilized by the flock of 300 sheep. Green panic-lucerne and Rhodes grass-lucerne plots yielded heavily. Winter production by the pastures is always much lower, and with areas of grazing oats and a reserve of some 100 acres of native pasture the present number of sheep (300) is regarded as the maximum that can be carried comfortably over this period.

Rotations

In general, crop yields in the rotation trials reflected the growing conditions, particularly the moisture status of the soil. Thus wheat following a fairly long fallow after sorghum (18.0 bus.) yielded up to 4 bus. per acre more than wheat following wheat or grazing oats, a result which could be attributed to the more favourable moisture status in the top 2 ft. of soil of the long-fallowed area for most of the season. Similarly, wheat following a standard fallow after wheat (16.0 bus.) yielded better than that after a green manure crop of Poona cowpea (13.3 bus.).

The effect of lucerne from cropping four years ago was still evident in a rotation trial on the shallower hillside soil, where comparisons between plots showed highly significant and substantial differences in levels of available nitrogen in favour of the ex-lucerne areas, and this condition persisted for the entire growing period of the wheat crop.

Grain sorghum yields in the rotation trials were generally high and yield differentials were related to differences in soil moisture status, as with the wheat crop. For example, on the shallower slopes the plots out of lucerne were at planting times very significantly lower in moisture below 12 in. than those after a short fallow, and the former yielded lower (52.9 bus. per acre as against 60.6 bus.). Similarly, on the deeper alluvials the ex-fallow plots (90.8 bus.) were better than those ex-cowpeas (84.3 bus.).

General

The Station has become an attraction for touring visitors with agricultural interests as well as for organised groups of agricultural scientists, farmers, junior farmers, and school pupils. This aspect of Station activity is considered important as it is a means of informing interested people of the nature and extent of work carried out by the Department.

GATTON

This Station has functioned as a Regional Experiment Station for a little over two years. Prior to that it was conducted as an Irrigation Research Station by the Bureau of Investigation of Land and Water Resources. The programme of pasture work established by the Bureau has been continued, while activities have been expanded to include investigations relating to the important agricultural crops of the Lockyer Valley.

Rainfall over the summer was above average, and following a fall of approximately 20 in. in the catchment in mid-February, a record flood was registered in Lockyer Creek. A heavy hail storm in early November caused considerable damage to pumpkin and bean crops in the Gatton area.

Growing conditions for pastures were generally favourable. Approximately 35 in. of water were applied to the irrigated pastures over the year to supplement the rainfall.

Irrigated Pastures

Sod-seeding Trials.—Sod-seeding of grass species into established clover stands could have useful practical application, as, for example, in places where grasses will not thrive until the clover has improved the level of soil fertility, or where the grass component has been reduced by selective grazing or by some other cause. Success was achieved in trials with introduction of H1 and Italian ryegrasses into both Irrigation and Ladino white clover, but establishment of *Phalaris arundinacea*

has not been satisfactory so far. Useful leads are now being followed, however, which are expected to solve the problem of sod-seeding this valuable grass.

Trials of Simple Mixtures.—It has been found that complex mixtures of irrigated pastures tend to lose their identity unless skilfully managed. Trials over a period of years with a number of simple mixtures based on white clover have shown that such mixtures simplify management practices and facilitate retention of the grass component. A series of simple mixtures are preferable to complex mixtures, particularly because they can be grazed according to the seasonal production capacity of the various grasses used. Cocksfoot and H1 ryegrass both persisted well in the trials and gave good production over prolonged periods of the year (35-40 tons per acre per annum). Priebe's prairie, on the other hand, performed well for one year only. Although *Phalaris tuberosa* failed to persist, it was evident that this grass could be retained with less frequent grazing. However, this practice would result in considerable loss of grazing to be had from the white clover.

Standard Irrigated Pastures.—It is desirable to demonstrate that the knowledge obtained from earlier work in respect of establishment, management and compatibility of species can be applied to maintain permanently an irrigated pasture in a state of high productivity. To this end three areas of pasture were established some three years ago and have been subjected to a normal grazing routine.

The production on all three areas continued to be high and the pasture mixtures have satisfactorily retained their identities.

A mixture of H1 ryegrass, cocksfoot and Irrigation white clover has given an outstanding performance and should be a desirable mixture for the Lockyer district. It provides excellent quality fast-growing pasture from April to December when stock-raisers' needs are greatest. The green weight yield has been over 40 tons per acre per annum, with average weekly yields varying mostly from 0.7 to over 1.0 ton.

Phalaris arundinacea and white clover mixtures, with either H1 ryegrass or Priebe's prairie, have proved to be particularly useful in the January-April period when the irrigated summer species, paspalum and Rhodes grass, lose much of their value because of heavy seeding and lack of growth and, in the case of paspalum, the presence of ergot. At this period green growth production is of the order 0.7-1.0 ton per acre.

Irrigated Summer Pastures.—Irrigated summer pasture mixtures of paspalum, Rhodes grass and white clover are very productive from October to February and in this 5-month period provide approximately 80 per cent. of the year's grazing. The average grazing over the whole year approximates 1 cow per acre.

Land Utilization Trial.—Early strains of subterranean clover, especially Yarloop, grow and regenerate very satisfactorily in the Lockyer Valley when supplemental irrigation is used, and the pasture supplies five or six good grazings between May and October. Following seeding down of the clover, the utilization of the land to best advantage during the summer months poses a problem. If maize could be grown on the area without detriment to the seasonal regeneration and growth of the clover it would provide a method of profitably utilizing the land during the summer.

A trial to test this combination has been run over two seasons and has given very promising results. With maize grown in 6 ft. rows, the sub-clover has been equally as productive as where grown alone (23 tons per acre for the season), while the maize has yielded 50 bus. of grain per acre in the first season and 117 and 152 bus. this year for 6 ft. and 4 ft. rows respectively.



Plate 23.—A Land-use Technique Developed at Gatton Regional Experiment Station Allows Production of Crops in Spring and Summer and Pasture in Autumn and Winter. Maize as the summer crop yielded up to 152 bus. per acre.

The two phases of the cropping programme produce mutual benefits, the clover improving soil fertility for the benefit of the maize, while the final cultivation of the growing maize removes weeds and provides a good seedbed for the clover.

Other Investigations.—Comparative trials of Ladino and Irrigation white clover strains confirmed previously observed trends that Ladino eventually dominates the temperate grasses planted with it and becomes an almost pure stand, whereas with the Irrigation strain a desirable grass-clover balance is retained throughout. Ladino, however, because of its taller growth and resistance to summer heat, is superior as an associate of the summer-growing paspalum, Rhodes grass and *Phalaris arundinacea*. Strawberry clover-para grass combination is well suited to poorer drained areas and has provided all-year grazing.

Non-Irrigated Pastures

The non-irrigated pastures of green panic and Rhodes were most productive in the summer and autumn after good summer rains. A sward area of green panic and lucerne was best with an average grazing rate equivalent to 0.50 cow per acre. Green panic-lucerne in rows averaged 0.31 cow per acre and row green panic alone 0.28 cow per acre. Rhodes grass-lucerne as a sward averaged 0.35 cow per acre; as rows 0.33, and grass alone 0.38. Buffel grass (Gayndah strain) averaged only 0.12 cow per acre.

Crops

Lucerne.—Lucerne growth has followed the trends which have been apparent for about three years, and which essentially are related to the availability of sulphur as a plant nutrient. As reported previously, water from Lockyer Creek supplies sulphur (as sulphates), whereas the well water does not supply any of this nutrient. Areas watered from the creek produced about 9.0 tons of good quality hay per acre, while the areas watered from the well produced only 2.5 tons of hay of poor quality. Areas treated in 1955 with a heavy dressing of superphosphate (which supplies sulphur) and watered from the well also grew good lucerne, yielding about 9.0 tons of hay per acre.

Potatoes.—Planting conditions for the autumn crop were not good and germinations were somewhat irregular. Nevertheless, yields of the standard varieties were satisfactory, Exton yielding 6.0 tons per acre in the February-planted crop, and Sebago 5.8 tons per acre in the March planting. In the spring crop Sequoia was the highest yielding variety (average 7.4 tons per acre), followed by Sebago (6.6 tons).

Miscellaneous Crop Work.—In a wheat varietal and rust resistance trial a Puora x Kenya cross (PRA₄K₁5556) was the earliest variety and yielded well (47.1 bus. per acre). Other varieties in order of yields were LG5391 (47.0 bus.), LG5390 (44.7), K1S4604 (42.1), Festival (42.1), Spica (33.6), Celebration (23.3) and Gabo (6.2). The last was heavily infected with stem rust.

Facilities for experimentation were made available to other Branches of the Department and work conducted in this way has included oat and wheat nursery trials, onion weed control, pasture breeding trials, hybrid sorghum and sorghum smut trials, and fruit fly investigations.

Stock

Fat Lambs.—The results of the 1958 season fat lambs from Merino-Border Leicester ewes and Dorset Horn and Southdown rams were very satisfactory. The percentage of lambs marketed to ewes mated was 148. Growth of lambs was good. When slaughtered at 63 lb. liveweight the average age of lambs by the Dorset sire was 92.6 days and of those by the Southdown sire 97.3 days.

BILOELA

Investigations at Biloela Regional Experiment Station are related to summer and winter agricultural crops, rain-grown and irrigated pastures, dairying and pig raising.

The year presented some climatic irregularities and the effects of the 1957-1958 record drought were still apparent. The 1958 spring months were dry and summer crop plantings were not possible until December. The following monsoonal rains were light and irregular, and the season was characterised by long dry intervals. The occurrence of stem rust in wheat varieties previously resistant to this disease cause great losses and many widely used strains must now be replaced.

A widespread disorder in cotton which was distinguished by deformed bolls and premature opening caused heavy losses throughout the district.

An increased cotton programme was undertaken and although rain-grown crops suffered from dry conditions, satisfactory results were obtained from irrigated areas. A top yield of over 3,000 lb. of seed cotton per acre was obtained in one experiment.

Wheat.—Crops sown on land with good stored water developed favourably, although only 2.38 in. of rainfall was received in the growing period. However, potentially high yields were severely reduced by an October outbreak of stem rust. Gabo, a variety which was previously rust-resistant and the leading type for the district, was heavily damaged, while two Queensland-bred wheats (Spica and a Puora backcross, now named Kenora) exhibited reasonable resistance and yielded 33.3 and 27.3 bus. per acre respectively. Festival was also satisfactory with a yield of 29.0 bus. Varieties without resistance, such as Gabo, Charter and Pusa 4, produced approximately 20 bus. per acre.

A time-of-planting trial supported earlier findings that there is much advantage to be derived by early sowings, and the late May to early June period can be fully recommended. Annual testing of a range of varieties has strongly supported use of early-maturing strains in the Central Queensland wheat areas.

Safflower.—Pure seed of Horowitz variety was again produced and although yields were below 1,000 lb. of seed per acre, evidence was obtained to support the adoption of 14 in. row spacing and a sowing rate of approximately 27 lb. of seed per acre. Such a long-season crop requires very favourable moisture supply to produce high grain yields. Strain testing for yield, oil content and growth characteristics resulted in the selection of four promising strains from the 86 being studied.

Oats.—Stocks of disease-resistant oat varieties, such as Saia, Trispermia, Seminole, and Florilands, were increased to replace susceptible commercial varieties.

Summer Crops

Cotton.—In most plantings potential yields were seriously reduced by losses due to the prevalence of a disorder causing malformation of bolls and premature opening. Yields in some areas of irrigated crops were halved and losses in late-sown rain-grown crops were also severe. The condition, locally called "parrot beak", has not been defined, but nutritional and biological aspects are being examined. There is some evidence of imperfect pollination.

During the year further information was obtained with respect to the value of nitrogenous fertilizers and in some instances when nutrient and water supply were well balanced, cotton production was doubled.

Rain-grown crops could not be planted until storm rains were received in December, and subsequent dry periods further reduced crop prospects. Harvesting commenced in June and yields are unlikely to exceed 500 lb. seed cotton per acre. The data from the investigations, which included testing of varieties, rotations, fertilizers and weedicides, are being evaluated.

Irrigated cotton crops were sown to schedule in October, and although some high yields were obtained in harvestings to date, the yields from many trials have been considerably reduced by losses from malformed and prematurely opened bolls.

In the standard variety trial, D & PL14, Empire and MBC 8-10-0 2 averaged 600 lb. seed cotton per acre from the first pick, while Miller 43-9-0 and Lankart produced less than 400 lb. per acre. These same varieties when fertilized with 200 lb. of nitrogen in split applications gave approximately twice as much. A light second pick will be obtained.

In comparing yields of Miller 43-9-0 fertilized with nitrate of soda and sulphate of ammonia respectively at rates to supply 0, 47, 94, 141 and 189 lb. of nitrogen per acre, similar responses were obtained from the two fertilizers. There were yield increases of approximately 300 lb. to 800 lb. of seed cotton per acre from different rates of application, although proportionate increases were not obtained in treatments receiving over 94 lb. of nitrogen.

A comparison of plant spacings of 4, 6, and 12 in., with 240 lb. of nitrogen added in split applications, resulted in yields to date of 1,384, 1,368 and 1,294 lb. per acre respectively. The same spacings without added fertilizer produced 582, 659 and 724 lb. respectively, indicating that plant population must be related to the levels of fertility. Boll malformation did not interfere with yields from a cotton entomological trial wherein an assessment was made of fertilizer applications, DDT sprayings and use of the fruit-setting hormone-type chemical ANA. Increased yields were obtained from fertilizers and from DDT applications, whereas ANA applied twice at strengths of 10 p.p.m. suppressed cotton yields. Six treatments yielded over 2,000 lb. per acre on incomplete harvests, and the three heavily fertilized treatments receiving weekly sprayings of 0.1 per cent. DDT averaged over 3,000 lb. of seed cotton per acre.

Grain Sorghum.—In the standard variety trial, seeding rates were adjusted to obtain equivalent plant populations of all varieties. Wheatland 44.5 bus. per acre, Caprock 35.4, Martin 34.5 and Alpha 34.5 outyielded Kalo and Early Kalo, which gave less than 30 bus. per acre. It was considered that the small-seeded Alpha variety would perform better with an increased plant stand.

Sweet Sorghum.—Sugardrip again showed good drought resistance and produced 15-20 tons of forage per acre under rain-grown conditions. Some 200 tons of silage were conserved. Mixed sowings of sweet sorghum and velvet beans produced equally well, and although the nutritive values in silage were comparable to sweet sorghum alone, the mixture produced better weight gains of steers, due probably to improved palatability of the silage mixture.

Cowpeas.—Seed increase of disease-resistant varieties of cowpeas, such as Malabar and Havana, was restricted by poor seed setting, but satisfactory yields were obtained from Black, Santiago and Blackeye 5 strains.



Plate 24.—Sugardrip Sweet Sorghum and Velvet Bean Are Grown Together as a Silage Crop at Biloela Regional Experiment Station.

Soybeans.—Very satisfactory growth was recorded in a trial of seven soybean varieties, but seed production was poor. If high-yielding varieties can be developed, these protein grains should be of great value for live-stock feeding.

Pastures

Plant Nursery.—Observations on the performance of a number of summer-growing and temperate-climate species justified establishment of sward plots of the more important material for detailed study.

Special attention has been given to three strains of green panic which exhibit improvement on the commercial variety. Early-seeding strains of the legume *Glycine javanica* are also promising. A number of introduced species of *Dichanthium* are under study and a successful establishment of an excellent elephant grass strain was made from seed. This strain has previously been propagated only by vegetative material.



Plate 25.—*Phalaris arundinacea* and Ladino White Clover Irrigated Pasture Mixture at Biloela Regional Experiment Station.

Among the temperate species mainly used for irrigated pastures, the commercial strain of *Phalaris arundinacea* was superior to several introductions and great variation in seasonal growth was recorded. All strains of

Phalaris tuberosa showed poor persistence. The interspecific *Phalaris* hybrid, Ronpha grass, outyielded all other *Phalaris* strains and some fertile seed was obtained.

In the *Bromus* group the most promising strains were Southland and Fisher of *B. inermis*, and Lamont and Priebe's strains of *B. catharticus*.

Potomac ryegrass, introduced from America, and a number of H1 ryegrass selections appear suited to the environment if grown with adequate water.

Seed harvesting of Biloela and Gayndah strains of buffel grass was continued to provide "mother seed" for distribution to growers of certified seed.

Rain-grown pastures.—The production of all rain-grown pastures was retarded during the spring, but active regrowth commenced after the December rains. The dry period was particularly severe on lucerne in mixtures, and subsequent vigorous grass growth depressed legume production. Green panic provided light but useful grazing after light spring rains, and the main summer growth when combined with lucerne provided 9.66 tons of green material per acre in the period December 29–April 8.

Biloela buffel grass withstood drought conditions and a 5-year-old stand produced excellent grazing.

The three main species, Rhodes grass, green panic and buffel grass, are far superior to native pastures.

Irrigated Pastures.—At the completion of the fourth season some important principles of management have been clarified. Under grazing, complex mixtures of legumes and grasses revert to simple mixtures of one clover and one grass. Ladino clover has been outstanding and is superior to other strains of white clover in the Central Queensland environment.

A pasture of Ladino clover and *Phalaris arundinacea* has proved to be the most stable mixture for spring and summer production and it continues into autumn, while Ladino and perennial prairie grass has shown promise for sustained autumn and winter production. Pastures based on lucerne are promising for conditions where circumstances prevent the adoption of a full watering schedule which is so necessary for clover-based mixtures.

In view of results at the Gatton station the use of self-regenerating, annual type pastures is also being studied at Biloela. These pastures provide fodder for the autumn, winter and early spring period, when native species are unproductive, but they require no attention in the summer, and the land can then, in fact, be used for short season crops.

Studies on growth rate and forage production indicate that Ladino clover and grass mixtures require a 28-day interval between grazings for optimum use. The lucerne and lucerne-based mixtures can also be managed on this schedule during summer, but a 42-day interval is more favourable in winter.

In investigating head ditch losses of water it was shown that seepage may account for up to 480 gal. per chain per hour, and, with low output facilities, methods for more efficient water distribution are required.

Stock

Dairy.—Two dairy herds have been maintained, one grazing on rain-grown pasture supplemented by grazing crops and silage, and the second principally on irrigated pastures. These stock, with herd replacements and some steers, were satisfactorily maintained on the pastures and on conserved fodder during the drought period of 1958.

Details of cattle investigations are reported by the Cattle Husbandry Branch.

Piggery.—Under local conditions, palatability trials showed that pigs preferred wheat to sorghum or maize, and sorghum to maize.

In early weaning trials, piglets which were reasonably well grown and over 15 lb. at four weeks of age made satisfactory growth after weaning to a specially prepared ration.

The addition of sugar to pig rations increased palatability but in some cases the tendency towards overfat pigs was accentuated.

Further details of the experimental programme are reported by the Pig Section.

THEODORE

This centre, which is operated as a subsidiary of the Biloela Regional Experiment Station, is situated in the Theodore irrigation settlement. Since operations commenced in July 1957, work has been directed to the development of suitable irrigated pastures and to the evaluation of methods of sheep husbandry and fat lamb production. During the current year preliminary trials were conducted with cotton and lucerne. The property has an area of 50 acres, most of which is irrigable but subject to inundation by high floods in the Dawson River. Fortunately, the river did not reach major flood height during 1958–59 and restoration of pastures destroyed by flooding in 1955 and 1956 has been satisfactory.

Pastures

Spring and summer pasture production from Ladino clover and paspalum was excellent, and rotary mowing of the tall grass prevented stalky unpalatable growth. White clover did not produce as well as Ladino, and in annual pastures berseem clover was superior to burr medic.

Stock

In assessing the practicability of fat lamb production in this environment, a breeding flock varying from 200 to 300 has been carried. Corriedale and Merino ewes and Dorset Horn rams are used in time-of-lambing trials, and correlation of lamb production and pasture growth is being studied. Time of lambing is also influenced by seasonal limitations. November mating and lambing in April coincided with depressed autumn pasture growth and the lambs (100 per cent. marked) required five months to reach maturity with a carcass weight of 33 lb. March mating and August lambing (109 per cent. marked) was very satisfactory; lambs gained weight evenly and most were marketed in less than four months. April mating and September lambing (114 per cent. marked) though satisfactory from a pasture production viewpoint, was not suitable for quality lamb production because high temperatures and humidity in January checked weight increases and sandfly worry was severe in February and March.

March matings are at present most promising. The lambs have maximum pasture growth available in spring and early summer and they can be marketed before the main wet season. It has been shown that twice the number of stock can be carried during the spring and summer period than during autumn–winter, and this finding presents a basis for further study of appropriate techniques for sheep and pasture management.

Crops

Cotton.—In a cotton fertilizer trial responses to nitrogen, potash or phosphorus were masked by losses caused by an unidentified disorder of young bolls. Potential yields of over 2,000 lb. per acre were reduced to an average production of 567 lb. seed cotton per acre by boll deformity and premature opening.

Exploratory Plots—Gibbergunyah

Studies have been initiated in conjunction with the Irrigation and Water Supply Commission on methods of developing heavy dark brown melon-holey soil areas within the Gibbergunyah settlement west of Theodore. Three areas each of five acres were treated at varying degrees of levelling and a programme based on permanent use for irrigation in one, two or three years was commenced.

Although high-cost earth-moving and ripping of hard exposed subsoils is necessary for pre-crop levelling in the first year, this procedure appears to be more satisfactory than partial levelling and use of rain-grown crops for one or two years with further levelling between crops.

Cotton, maize and sorghum were grown on the area completely levelled for irrigation. Crop growth was patchy but better than anticipated. Maize and sorghum yielded approximately 25 and 40 bus. per acre respectively and cotton produced 785 lb. seed cotton per acre.

The two unwatered areas were cropped to oats and field peas for grazing.

Preliminary results indicate that the costs of complete initial levelling may be justified by the return from cotton as a pioneer crop.

AYR

Although sugar-cane is the principal agricultural crop in the Burdekin Delta, where this Station is located, there is much land that could be utilized for the production of other crops, including pastures, and the Station's activities are directed towards investigations of these crops. Abundant water is available for irrigation from underground supplies and is extensively used to supplement the rainfall over the dry period April-December, when mild temperatures permit the growth of temperate-climate crops in an "out-of-season" period.

The weather in the second half of 1958 was exceptionally dry, only 4½ in. being recorded over the 7½ months from mid-April to early December, and because this fell in small amounts it was of no practical value. Irrigation was used extensively until storm rains gave relief, some 16 in. being received from this source in December and January. A severe cyclone in February 1959 battered crops and damaged buildings. The blow lasted for some 11 hours and brought 7 in. of rain.

No further heavy rain was received during the season, the very moderate falls in March totalling a little over 4 in. The remainder of the period under review was dry and irrigation had to be resorted to much earlier than is generally the case.

The winter temperatures in 1958 were mild and no frosts were recorded, while no excessively high temperatures were experienced throughout the summer. These two factors may have been partly responsible for the increased insect activity in crops during the first half of 1959.

Crops

Cotton.—Varieties having fewer but larger bolls yielded better in a variety trial than D and PL, which has a larger number of small bolls. It would seem that a nutrient shortage was felt by this variety, which is notable for its late crop potential. Acala 5675.10 yielded best with 967 lb. per acre.

In a nitrogen fertilizer trial, the slow-acting uramite yielded better (1,365 lb. per acre) than the quick-acting sulphate of ammonia, but the difference was not significant.

A comparison was made of the relative merits, with respect to the following cotton crop, of legumes, non-legumes and a clean fallow as wet-season cover crops. Sugardrip sorghum (3.4 tons dry matter per acre), weeds (1.0 ton) and Malabar cowpea (1.4 tons) were ploughed under and cotton planted five weeks later. The best yield of 1,335 lb. cotton was from the ex-legume plot followed by clean fallow (1,255 lb.), sorghum (1,097) and weeds (1,040), the ex-legume yield being significantly higher than those after sorghum and weeds. This result is interesting in that it suggests that the non-legumes cause a depletion of the available nitrogen supplies even under the favourable conditions for decomposition that are generally experienced in the late summer-early autumn period. A further similar experiment is now being conducted in which nitrogen is being supplied as fertilizer before and during the cotton crop.

The most favoured planting time for cotton in this district is immediately after the wet season, usually in March or April, when advantage can be taken of warm temperatures and moderate, but not excessive, rainfall. Because no data were available for plantings in the "winter" months, a trial was conducted of plantings in late-June, late-July and early September. Yields of 1,556 lb. and 1,458 lb. per acre respectively were obtained from the two earlier plantings, but it was not possible to harvest the September planting before the wet season set in. The remarkable feature of this

trial was the absence of insects in the crop. On the other hand, irrigation costs were high, the crop being grown solely on added moisture.

Maize.—It has been shown by earlier work that good crops of maize can be grown in the lower Burdekin by planting after the wet season in March and April. With the usual practice the crop follows a weed fallow. As there are obvious advantages in using a leguminous cover crop in the wet season, a trial was run to compare the merits of such a cover crop (mung bean and velvet bean mixture) with those of a weed fallow in relation to the following maize crop. Dry matter amounting to 1½ and 1 ton per acre were ploughed in from the legume and weeds respectively and the maize was planted three weeks later. Although 2 cwt. of sulphate of ammonia per acre was applied to both treatments after the ploughing-in, the yield of grain was better after the legume (93 bus. as against 81 bus. per acre.) This result again emphasises the need to add nitrogen to offset loss of available nitrogen by leaching and "tie-up" by added carbohydrates.

Legumes for Seed

The climate of the Lower Burdekin Valley is particularly suitable for seed production. Some 100-500 lb. of seed was produced of the tropical legumes centro, stylo, glycine and various strains of these, and 380 lb. of Santiago cowpea. In addition, over 1,900 lb. of seed of Redlands Belle French beans were grown under a certified seed production programme.



Plate 26.—*Glycine javanica* is One of the Useful Pasture Legumes for Which Seed Harvesting Methods Have Been Developed at Ayr Regional Experiment Station.

Nut Grass Control Trials

A trial to ascertain the value for nut grass control of cultivation during the early summer, as compared with hormone spraying at appropriate times throughout the wet season, was commenced in October 1958. Ordinary cultivation times were shown to be of little value, but the use of an adaptation whereby a horizontal knife blade is drawn through the soil at a depth of 6 in., so cutting the majority of the nut chains, proved beneficial. The hormone 2,4-D was used, MCPA, which was used initially, having been shown to be less effective. Sprays were made at approximately monthly intervals between December and March at the rate of 2 lb. active ingredient per acre. Counts of viable nuts in April 1959 showed greatly reduced nut numbers. Figures expressed as percentages of those present in the control areas were:—

Control areas	100
Dry cultivation, followed by cover crop	90
Hormone only during the wet season ..	27
Dry cultivation and hormone during wet season	9

Pastures and Stock

Over a period of seven years, trials have been conducted to evaluate various pasture mixtures under irrigation for beef cattle fattening. In that time cattle of various ages and of two breeds have been used, and it has been shown that para grass-centro mixture is the most productive in terms of liveweight gain of stock. The work recently proceeded a further step by investigating the best time to introduce yearling cattle onto these improved tropical pastures for intensive fattening. The indications were that September might be the best time for fattening to commence.

Horticulture

Pineapples.—The time-of-planting and "gassing" trial was continued into the first ratoons. Results from the plant crop indicate that the best practice would be to plant in December-January and "gas" 10-12 months later.

The rough-leaf varieties flowered naturally in December and produced reasonably sized fruit—up to 3 lb. for Alexandra and 2-2½ lb. for the Queen strains.

Bananas.—The mulching experiment (using megass) was proceeding satisfactorily until the cyclone in February destroyed the plants. At that time they had reached full height and the unmulched plots were requiring more frequent irrigations than the mulched plots to maintain soil moisture at the desired high level.

Tomatoes

P3 and Bowen Red varieties again topped the yields in the trellised tomato varietal trial. On another section bushes that were not trellised were observed to yield better and the fruit was not so susceptible to disease as on the trellised rows.

MILLAROO

At the Millaroo Station, located on the Burdekin River 40 miles upstream from Ayr, the programme of agricultural investigations and pasture trials has been extended as further areas of land have been developed. The main crops include tobacco, cotton, maize, sorghum and beans, and studies are in progress to determine the potential production of several other crops and of pastures on the principal soil types in the areas to be serviced by the Burdekin River irrigation project.

This area of Queensland presents some unique agricultural problems relating to soil and crop management. The marked summer wet season supplies over 80 per cent. of the annual precipitation of 35 in. and yet with mild winter conditions and irrigation water it is possible to produce during the cool period of the year many crops generally regarded as adapted only for summer culture. Thus plantings may appear to be "out-of-season" in comparison with other agricultural areas of the State.

Crops

Tobacco.—Trial plantings over 3½ acres gave an average yield of 1,234 lb. leaf per acre and returned £632 per acre.

In studying the effect of Rhodes grass management on the following tobacco crop, late ploughing gave greatly reduced yields of leaf and lowered values. The highest yields of 1,283 and 1,307 lb. of leaf followed removal or burning of grass and early ploughing.

In a rotation trial embracing pasture, tobacco and other crops, similar yields were obtained from tobacco after Rhodes grass and after tobacco in the second successive year and the returns of £710 and £704 per acre respectively were also comparable.

No significant differences were obtained in yields of tobacco following seedbed treatments for nematode control with methyl bromide, methyl bromide and nitrogen, and heat sterilization by burning antbed. Production averaged 1,432 lb. leaf per acre.

Three rates and nine combinations of nitrogen, potash and phosphorus were employed in a tobacco fertilizer trial on new land. Yields of leaf ranged from 1,380 lb. to 1,487 lb., and although weight difference was not significant, data now being examined indicate that slight variation in leaf value may occur due to fertilizer balance.

Cotton.—Damage to young plants by cyclonic winds and rains in April and general insect losses occurred. In a variety trial yields of seed cotton were Acala 5675-10-2, 920 lb.; Arkot 2-1, 808 lb.; Miller 43-9-0, 770 lb.; Empire, 762 lb.; Bobshaw, 744 lb.; and D & PL14, which has been outstanding in previous years, 732 lb.

Significant differences were not obtained between yields of 839, 829, and 794 lb. of seed cotton per acre from populations of 12,000, 20,000 and 40,000 plants per acre.

Maize.—Despite damage to young plants by cyclonic winds two trials were completed. In testing of varieties, Jubilee, Victory and Q526 yielded 107, 102 and 100 bus. per acre respectively and five others produced from

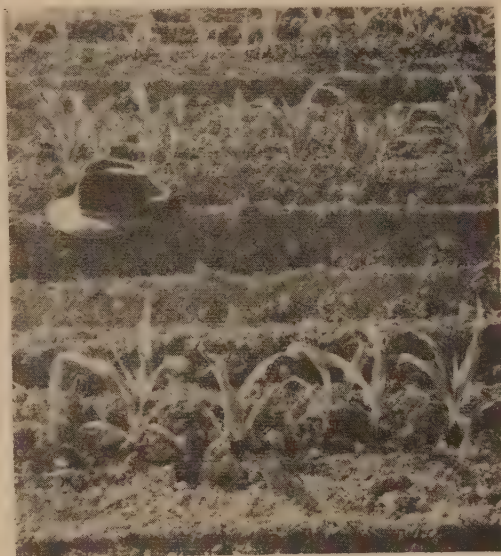


Plate 27.—Trials Such As This One on Millaroo Regional Experiment Station Have Shown that Good Plant Stands of Maize Are Necessary for High Yields.

64 to 90 bus. per acre. In repeated testing over four years Victory and Jubilee have been the superior varieties, while Q526 and Q23 have been the best of the Queensland hybrids.

A combined fertilizer and plant spacing trial produced yields ranging from 70 to 100 bus. per acre and supported previous findings that close spacing is advantageous, provided plants receive adequate nitrogen. Results over recent years have shown that side-dressings of 320 lb. of sulphate of ammonia are desirable for the best economic yield, and plant spacings of approximately 8 in., to give 16,000-18,000 plants per acre, are recommended.

French Beans.—In addition to production of 40 bus. of certified seed from two acres of the new variety Redlands Beauty, studies were made of the fertilizer requirements of this crop. Yield differences were not significant and basal dressings of 800 lb. of 4.5: 15.5: 2.5 and 400 lb. 10:10:0, each side-dressed with 120 lb. of sulphate of ammonia, gave the highest yields of 26.2 bus. per acre. Green bean yields averaged 12,500 lb. per acre.

Cowpeas.—Seed production areas of the variety Malabar produced at the rate of 500 lb. seed per acre.

Trials on Flood Plain Soils

Fairly extensive areas of the heavy Oaky and Barratta soil types have been developed for crop and pasture trials. During the year a number of crops were sown to ascertain their potentialities and fertilizer requirements.

Rice.—Five commercial varieties and six strains from the Kimberley area were sown in March to gauge the effect of the cooler growing season on production. Previously fair yields were obtained from early plantings for growth during the wet season.

Although germination and growth were satisfactory there was considerable seed abortion due to poor pollination in the lower temperatures during the May and June period. Sterility ranged from 37 to 98 per cent. of heads. The Meli and Calora varieties, which were least affected, produced 56 and 42 cwt. of unhusked grain per acre respectively. The Kimberley strains averaged approximately 27 cwt. per acre, although there was a high degree of head sterility in these varieties.

Maize.—August-planted maize, which received complete fertilizer at various rates and extra nitrogen at two rates as a later side-dressing clearly showed that nitrogen was the main nutrient deficiency. No differences in yield were obtained from basal dressings, but the addition of 160 and 480 lb. of sulphate of ammonia as side-dressings at hilling time in September resulted in average yields of 15.8 and 42.1 bus. per acre respectively.

Miscellaneous

Exploratory trials with pumpkins, sunflowers, sorghum, oats, linseed and canary seed produced variable results. Establishment of small-seeded crops presented some difficulties on soils which waterlogged, and although complete fertilizers assisted growth the main response was due to nitrogen.

Pastures

Grazing of para grass and centro pastures commenced in June 1958, and 11 steers were maintained on the area of 20 acres until October. After allowing the legume to make stronger development grazing with 16 steers was recommenced in May 1959. Weight changes will be recorded.

As part of the study of plant nutrient requirements on Oaky soils, six fertilizer treatments were applied and a range of grasses and legumes established to measure responses. Grasses sown from seed, including species of *Panicum*, *Paspalum*, *Chloris* and *Cenchrus*, failed to germinate satisfactorily while those planted from vegetative material, such as *Setaria* spp., para, African star and elephant grasses, showed some promise. In all cases the best responses were obtained from heavy applications of nitrogen. Lucerne, once established, produced well. Good responses were obtained from the legumes centro, glycine, pigeon pea and phasey bean, but calopo and blue lupins were inferior.

KAIRI

Activities at the Kairi Regional Experiment Station are based on investigations of the problems relating to agriculture, dairying, pig raising and poultry raising on the Atherton Tableland. The area receives an annual rainfall of 51 in., and on the elevated plateau, 2,000 to 2,400 ft. high, climatic conditions are temperate to subtropical. Agricultural practices are generally similar to those employed in southern Queensland, although modifications are necessary to utilize the very wet January-March period to advantage.

Maize production has been the main agricultural enterprise on the Tableland, but declining fertility and loss of soil structure indicate that soil husbandry practices based on cropping systems involving pasture leys would be desirable. Accordingly, studies in progress include the livestock industries, while considerable attention is directed to pasture research and fodder crop production.

Extremely dry conditions were experienced from July until the commencement of the wet season in December. Only 1.50 in. of rain were received in this dry period, during which stock relied mainly on conserved feeds. Land preparation for summer crops was seriously delayed by these dry conditions.

Crops

Maize (1957-58 crop).—Plantings were made in early January and favourable growing conditions were experienced in the early season. However, dry conditions and the influence of late land preparation limited cob development. From all plantings on the station, crops averaged 21 bus. per acre, and yields from experimental areas ranged from 13 bus. per acre in maize monoculture plots to 63 bus. per acre from the leading hybrid strain being tested. A combined fertilizer and plant spacing trial, involving applications of 200 and 400 lb. per acre side-dressings of sulphate of ammonia to plant spacings of 12 and 15 in. (11,400 and 9,700 plants per acre), confirmed results obtained in previous years. The closer spacing, which yielded 32 and 28 bus. per acre in duplicated trials, significantly outyielded the wider spacing, which yielded 29 and 26 bus. per acre, and there was no increase due to fertilizer treatment. Trials in the years 1952-1958 have shown that closer spacings have averaged 51 bus. per acre, against 45 bus. per acre from wide spacings.

In a repeated trial of 12 and 18 in. plant spacings on rich scrub soil the closer spacings yielded 32 bus. per acre, or 4 bus. higher than 18 in. spacings. This trial is designed to study the incidence of disease in areas cropped annually to maize. In the second year there was no difference in the incidence of disease but the closer spacings tendered to produce more barren plants.

Representative strains of durum and dent maize were again compared and yields ranging from 30 to 34 bus. per acre were obtained. In six years of testing the durum strains have slightly outyielded dent strains and have shown slightly better resistance to disease and weevil attack.

A trial of Grafton hybrid varieties again showed the superiority of GH 128, which produced 53 bus. per acre against approximately 30 bus. per acre from four other hybrids and the local durum maize. Twelve single-cross hybrids were tested, the two most promising yielding 57 and 63 bus. per acre.

Maize (1958-59 crop).—Spring drought conditions delayed land preparation and there was a lack of soil moisture during pre-planting cultivations.

Early crop development was very satisfactory but excessively wet conditions and a marked reduction in the average hours of sunlight in March, April and May resulted in dense weed growth, lodging of maize, and a severe outbreak of leaf rust (*Puccinia sorghi*), which could reduce yields. However, production is expected to exceed returns obtained in the previous year.

Oats.—Trials conducted each year in the period 1954-1958 have shown that March or April plantings produce more grazing than later plantings. Changes in varieties have been necessary to overcome losses due to crown rust. Vicland, which has been an excellent variety, is now quite unreliable although Bovah, which is also susceptible to crown rust, will still give profitable grazing returns if planted early. A study of 12 newer oat varieties indicated that no improvement can be obtained in yield over Bovah and Klein, but those possessing resistance to crown rust, particularly Saia, warrant further development.

Wheat.—Hay crops have given the best yield when planted in April, immediately after the main wet season. The varieties Lawrence and Celebration are most favoured.

Green Manures.—Mung bean (*Phaseolus mungo*) has been very satisfactory for green manuring and yields of up to 9 tons per acre of plant material have been obtained. In a test of varieties being developed, mung bean produced 7 tons per acre, while Cristaudo, Santiago, and Malabar cowpeas yielded 9.5, 10 and 12 tons per acre respectively in a 66-day growing period.

Fodder Cane.—The variety Co. 301, which yielded 50 tons per acre, was a valuable fodder reserve. Eighteen varieties obtained from the Sugar Experiment Station at Meringa are also being tested.

Miscellaneous Crops.—English and sweet potatoes, sorghum, Russian comfrey and cotton were grown for regional testing.

Pastures

Growth was checked by three severe frosts in July and the following long dry period was unproductive. The excessively wet, dull conditions in March, April and May, when the average daily hours of sunshine were 3.4, 5.4, and 3.2 respectively, were equally unfavourable for development of high quality grazing.

In filling the nutritional gap when pastures are unproductive, excellent results have been obtained in feeding grass pit silage. Grass production and nutritive value were increased by applications of nitrogenous fertilizers, and the larger number of animals that can be carried in the period of maximum pasture growth can be maintained on the silage during the dry seasons.

Studies are in progress on pasture management methods to provide for both good grazing and production of material for silage making.

Fertilizer experiments indicate that nitrogen is the main nutrient required for very high production from lucerne and grass pasture mixtures, and studies in recent years indicate that considerable economic benefits should be possible by systematic management and strategic applications of nitrogen equivalent to 4 cwt. of sulphate of ammonia.

In addition to studying the value of inorganic nitrogen, further progress has been made in utilizing legumes in grass pastures. Lucerne has many limitations under Kairi conditions, but the trailing tropical legume *Glycine javanica* has shown excellent results and it has been grown successfully with Rhodes, guinea, green panic, kikuyu and buffel grasses. The legume requires careful management until firmly established and it is equally important to maintain balance of the glycine may overrun the grass components of the pasture. A Rhodes grass and glycine pasture, when sampled in August, 12 weeks after grazing and eight weeks after a severe frost, supplied 8 cwt. of oven-dry pasture per acre, of which the glycine contributed 2.4 cwt. The legume contained 15.5 per cent. protein.

Silage made from 12 acres of Rhodes grass with some residual lucerne, which had been fertilized with 2 cwt. of urea per acre, contained 10.3 per cent. protein and the analysis indicated a production fodder intermediate in value on a dry-matter basis between good wheaten hay and fair quality lucerne.

Stock

Dairy.—The later part of 1958 was one of the driest on record but production was maintained largely by feeding silage. The Jersey herd averaged 240 lb. butter-fat per cow, equivalent to a production of 86 lb. butter-fat per acre over the demonstration farm unit wherein maize growing and dairy farming are combined. An A.I.S. herd is being built up and long-term investigations such as the study of lifetime concentrate feeding are now entering the second year.

Pig Raising.—In addition to studies on rations and weight gains of piglets weaned at four weeks of age and sow nutrition investigations, pigs have been utilized in determining the value of a range of grazing crops, of which fodder cane, sweet potatoes, arrowroot, lucerne and *Glycine javanica* are useful on the Tableland. During the year 143 pigs were marketed.

Poultry.—Trials to determine the economics of feeding meal and whole grain respectively when supplemented with meatmeal, and to assess the most economical level of feeding fibre, were continued.

Details of the various animal husbandry investigations are reported by the respective branches.

Extension

Field day activities were well attended, and many farmers, scientists and students visited the centre during the year. Planting material of fodder cane, arrowroot, elephant grass and *Glycine javanica* was distributed to 50 farmers. Articles have been published in Departmental publications and two officers contributed a paper on "The role of pastures in agriculture on tropical plateaux" to the Armidale Agrostology Conference.

BOTANY SECTION

About 9,000 specimens were identified during the year for officers of State and Commonwealth Departments, primary producers, schools and others interested in plants. These represented grasses, weeds, poisonous plants, forest trees, ornamentals and miscellaneous plants. Reports on their distribution, properties and economic significance were supplied when requested. About 90 samples of stomach contents were examined for suspected poisonous plants. Research was continued on systematic botany, weed and brush control, poisonous plants and the utilization of edible trees.

SYSTEMATIC BOTANY

Workers in all fields of botany cannot communicate their results unless the plants are accurately identified. Continuous research is necessary to elucidate the relationships of plants to one another, to delimit species and to ensure that they are correctly named. Work of this type was continued on various genera of the families Amaryllidaceae, Apocynaceae, Cupressaceae, Euphorbiaceae, Ficoidaceae, Gramineae, Guttiferæ, Himantandraceae, Hydrocharitaceae, Labiatae, Lauraceae, Leguminosae, Loganiaceae, Monimiaceae, Myoporaceae, Myrtaceae, Orchidaceae, Palmae, Portulacaceae, Proteaceae, Rutaceae, Saxifragaceae, Scrophulariaceae, Umbelliferae, Urticaceae and Zanicelliaceae.

These studies were supplemented by field collecting in several districts, notably the northern tablelands and the south-eastern Darling Downs.

Dr. S. T. Blake, of the Botany Section, was elected chairman of a committee appointed by A.N.Z.A.A.S. to examine a proposal for the preparation of a new Flora of Australia.

The following papers on systematic botany were published—"New criteria for distinguishing genera allied to *Panicum* (Gramineae)" and "New and critical genera and species of Myrtaceae subfamily Leptospermoideae from Eastern Australia" by S. T. Blake; "New Species of and notes on Queensland plants III. and IV." and "Corokia A. Cunn., an addition to the Australian genera of Saxifragaceae" by L. S. Smith.

The Honey Flora of South-eastern Queensland, by S. T. Blake and C. Roff (Adviser in Apiculture) was published in book form during the year. In this publication are described and illustrated the principal plants used by bees.

WEEDS

Several exotic plants were received from Queensland for the first time. Of these the most important was St. John's Wort (*Hypericum perforatum* var. *angustifolium*), found growing at Pechey. This plant is a very serious weed in southern Australia not yet established in this State. Following this report, the infestation was treated by officers of the Department of Public Lands.

Other new plants of interest were *Salpichroa rhomboidea* (pampas lily of the valley), a noxious weed in Victoria occasionally grown here as an ornamental plant, which was reported to be well established and spreading in a small area at Ipswich; and *Froelichia floridana* (snake cotton), a native of the United States which appeared in central-western Queensland in an area sown with imported buffel grass seed. Torpedo grass (*Panicum repens*), a vigorous grass which is a pest in orange groves in the south-eastern United States, was found growing in a Brisbane suburb.

Following the publicity given to the infestation of *Harrisia* cactus, numerous samples of various suspect succulents were received for identification. Only one was *Harrisia* and this proved to be from an area where the plant was previously unknown. It was reported to the Department of Public Lands. A brief field study of the main *Harrisia* cactus infestation at Collinsville showed that the plant was growing mainly in brigalow scrubs and it was suggested that the first step in control should be to change this favourable habitat by clearing the scrubs and replacing them with pasture rather than by putting the land out of production through wholesale use of arsenic.

A brief survey was made of nut grass infestations on tobacco land in the Mareeba-Dimbulah area. All infestations were of *Cyperus esculentus* and not the common nut grass (*Cyperus rotundus*) and all could be traced to irrigation water pumped from gravel beds in the Barron River or the Walsh River. Recommendations were made that the distribution of the weed be plotted accurately after good rain and that care be taken to ensure that all sand and gravel used in the construction of new irrigation works be taken from pits free of nut grass.

Plots of skeleton weed (*Chondrilla juncea*) in the Kingaroy district showed no regrowth 12 months after treatment with large amounts of commercial borate preparations or fumigation with methyl bromide. There was some regrowth on plots treated with sodium chlorate. As a result of these trials, it was suggested to the Co-ordinating Board of the Department of Public Lands that the known infestations of this weed could be eradicated by treatment with powdered borates at 2,000 lb. per acre.

Specimens of soursob (*Oxalis pes-caprae*) were received from Landsborough and Pittsworth. Since this is a serious weed in southern Australia, a recommendation was made to the Co-ordinating Board that it be declared noxious.

At the request of the Co-ordinating Board, infestations of prickly acacia (*Acacia arabica*) were studied in the Barcardine, Longreach and Winton districts. It appears that the present dense infestation around Winton is the result of unusually favourable seasons since 1950 and there was some evidence that trees within the thickets were beginning to die spontaneously. However, the growth was so dense that movement of livestock was being impeded and mechanical clearing was recommended. Mature trees provide useful shade, shelter and fodder and it was recommended that there be no wholesale destruction of the older trees.

At the first Australian Conference on Aerial Agriculture, contributions were made on the use of aircraft in brush control. The general feeling at this conference was that aircraft have a definite place in agriculture in Australia but that greater co-operation between aviation authorities, aircraft operators and agricultural workers is necessary if the industry is to operate to the best advantage. The conference was an important first step in this direction.

A limited trial on Johnson grass (*Sorghum halepense*) confirmed American reports that dalapon is more effective against this species if applied in small doses at frequent intervals than if applied less frequently in larger doses. In this trial three applications of dalapon each of 5 lb. per acre at weekly intervals gave better control than two applications each of 10 lb. per acre, despite the fact that the grass was more than 7 ft. high and almost mature when spraying began in February. This work is to be followed by further tests in the spring or early summer.

BRIGALOW

The survey of methods used in controlling brigalow was continued in the Goondiwindi-Tara-Glenmorgan district and the Wandoan-Taroom district. The former is almost entirely devoted to sheep raising, the second to cattle, and this difference in land use influences the methods used to control brigalow. Irrespective of these differences, soil moisture appears to be a major factor in the success of all methods of brigalow control. Best results are obtained when soil moisture levels are high.

More than 90 per cent. of present clearing is being done by tractors dragging chains or cables. Most of this clearing appears to have been successful but failures

have occurred where graziers have failed to use satisfactory follow-up measures or have cleared areas too large to manage correctly. It was apparent that at least in sheep areas provision of sufficient fencing and watering facilities is a basic requirement for controlling brigalow suckers and in cattle country adequate subdivision is needed to allow establishment of sown pasture.

Where sheep were being used to control brigalow suckers it was obvious that early stocking is essential for success. This prevents the development of much grass and forces the sheep to eat the suckers as soon as they appear. If grazing is deferred, suckers are often too large to control by the time the sheep have eaten all the grass and herbage and have been forced to turn to the brigalow. Stocking rates needed to control brigalow suckers varied fairly widely but ranged from about 1 to 2 sheep per acre on pulled virgin scrub to 5 or more sheep per acre in pulled sucker country. On any property the acreage which can be pulled with safety is determined by the number of sheep which are available for controlling regrowth.

In cattle country insufficient properties have been studied to reach definite conclusions but present indications are that it is advisable to defer burning for at least 9-12 months after pulling, probably longer. As soon as possible after burning, Rhodes grass is sown into the ash, and the grass is protected from stock until it has seeded.

The problem of controlling dense, old stunted brigalow suckers still remains unsolved. Chemicals have given inconsistent results, pulling is not usually practicable and ploughing is only useful on areas which are fairly free of old fallen timber. Further experiments on aerial spraying of this kind of brigalow were carried out in the Hannaford-Meandarra area and in the Westmar-Bungunya area. In these trials 2,4,5-T was dissolved in oil and applied at rates of $\frac{1}{2}$ lb., 1 lb. and 2 lb. 2,4,5-T acid equivalent per acre in total volumes of $\frac{1}{2}$, 1, 2, 4 and 8 gal. per acre. Using a fixed-wing aircraft, two such trials were laid down, one in February, 1958, when the weather was warm, the soil was moist and the brigalow in vigorous growth, the other in June, 1958, when the weather was cold and the brigalow dormant. At the same times the same chemicals at the same rates were applied to suckers in their second year of growth following a burn. At least two years will elapse before results are known with any degree of certainty.

In the small-scale trials laid down last year at Jandowae, it appears that under the conditions of the first trial there is no difference in effectiveness between the low volatile ester of 2,4,5-T and the ordinary butyl ester. Plots treated by helicopter have shown very poor kills and the machine used in this trial has no advantage over a fixed-wing aircraft for brigalow spraying. It is possible that other types of helicopters may give better results.

SUSPECTED POISONOUS PLANTS

About 90 samples of stomach contents were examined for suspected poisonous plants. In the majority of cases, such examination threw no light on the cause of death of the animals concerned but in several instances cause of death was determined or confirmed in this way. Amongst these were caustic vine (*Sarcostemma australe*), found in the ruminal contents of a sheep from the Winton district, Ellangowan poison bush (*Myoporum deserti*) from sheep which died at Wyandra, *Kochia tomentosa* var. *tenuifolia* and black pigweed (*Trianthema portulacastrum*) from sheep which died in the Jambin district with symptoms of oxalate poisoning. Pods and seeds of weir vine (*Ipomoea calobra*) were found in the rumen contents of a sheep which died in the Roma district with characteristic symptoms of incoordination. The leaves of this plant are known to produce this syndrome but usually the condition occurs in early summer and not later in the season when the plants are seeding.

About 50 other cases of suspected plant poisoning were added to the poisonous plants files.

At the Fifth Australian Phytochemical Conference in Adelaide it was obvious that a very large amount of research is in progress on the chemistry of Australian plants, mostly Queensland species, but that only a small percentage of this work is devoted to poisonous plants.

HERBARIUM AND LIBRARY

The new fireproof annexe was completed and most of the library was moved to this building. Classification of the books was completed and 125 volumes were bound.

About 1,750 type specimens were transferred to the new annexe. A total of 7,100 specimens was mounted and incorporated in the herbarium. To other institutions

1,870 specimens were sent on loan and about 140 were received. Approximately 590 specimens were distributed on an exchange basis: 1,040 were received.

VISITING BOTANISTS

Visiting botanists who worked in the herbarium during the year included Dr. R. Cooper, Auckland; Prof. and Dr. H. Walter, Stuttgart, Germany; Dr. O. A. Leonard, Davis, California; Prof. R. Thorne, Iowa; Mr. J. S. Womersley, Lae, New Guinea; and Dr. L. J. Brass, Lake Placid, Florida.

ENTOMOLOGY SECTION

With seasonal conditions normal in most districts, the effects of basic natural and cultural controls were considerable. Generally pest populations were either negligible or could be handled economically by secondary or chemical methods. A similar population range primarily influenced field investigations: some efforts were lost through insufficient pest infestations, while in other instances conditions, including both pest and plant behaviour, were helpful.

Fruit fly required slightly more attention than usual, and there was an upsurge of tortricids in several crops. A few instances of infestations induced by unnecessary spraying were recorded, and as an aftermath of abnormal seasons during the previous two years some pests, such as white wax (*Ceroplastes destructor* Newst.) on citrus and leaf miner (*Gnorimoschema operculella* (Zell.)) in tobacco caused concern in limited areas. None of these was of major importance.

With the return of another two entomologists from study tours overseas, research in their specialised fields of fruit flies and nematodes has been intensified. Two more field stations were established, both in North Queensland—one to cover the requirements of tropical entomology, and the other to help in the expansion of fauna studies on a State-wide basis. Arrangements have been made to open a field station in the south-west: this will serve as a base for preliminary work on marsupials and cotton pest research in that area. To keep abreast of modern trends in insecticide research, and to supplement the usual field work, a suitably staffed central laboratory is being planned.

DECIDUOUS FRUITS

In the Stanthorpe district, large overwintering codling moth (*Cydia pomonella* (L.)) populations did not result in subsequent outstanding infestations. Generally this pest was well controlled, and in those instances where difficulties were encountered thorough checks on causes were made. Some orchard trials were only lightly infested, while the results from others demonstrated that DDT is still the best insecticide for the control of this pest, and the inclusion of some of the newer materials in future programme trials is warranted. Mites were not prevalent, and therefore a large series of trials was not profitable. The light-brown apple moth (*Tortrix postvittana* (Walk.)) was much more active and persistent than for some seasons, and commercial controls as applied gave mixed results. With rain during the ripening period of stone fruits in December, fruit fly (*Strumeta tryoni* (Frogg.)) caused some losses. At Warwick, a transient appearance of the plague locust (*Chortoicetes terminifera* (Walk.)) as a scattered population damaged apricot fruit approaching maturity, and to a lesser extent foliage.

TROPICAL FRUITS

A thorough survey of pests of bananas in North Queensland has been completed, with the immediate result that research on nematodes, rust thrips (*Scirtothrips signipennis* Bagn.) and scab moth (*Nacoleia octosema* (Meyr.)) has been intensified: efforts with the last two cover insecticide screening trials and further checking of proven commercial controls. Injudicious use of insecticides on bananas throughout the State on many occasions created a mite problem.

Investigations of nematodes associated with pineapples and papaws are proceeding satisfactorily, and give promise of worthwhile economic results.

CITRUS

White wax still requires attention in southern Queensland, where tortricid larvae were also more than usually troublesome: otherwise standard controls were reasonably satisfactory. Probably the best of the fruit fly controls in Queensland is in citrus, and it is also the simplest control of a pest in that crop. Where the natural desire for a change coincided with infestations of this pest source, appreciable losses occurred. Trials against the Maori mite (*Phyllocoptruta oleivora* (Ashm.)) and other mites indicate that for the present sulphur should be retained in commercial spray programmes. Some field work with fruit-sucking moths (*Othreis* species) was carried out, but during the past season these pests appeared only sporadically.

FRUIT FLIES

General routine field investigations were maintained, and some phases of laboratory research were expanded. The Senior Entomologist leading the research with these pests undertook a study tour of North America and Hawaii on behalf of the Department of Primary Industry and this Department, and a comprehensive report has been circulated to other interested organisations.

TOBACCO

The tobacco looper (*Plusia argentifera* Guen.) and bud-worms (*Heliothis* species) were present in small numbers in most central and northern districts, and were readily controlled. Leaf miner (*Gnorimoschema operculella*) caused concern in northern areas late in the season, and was particularly severe in rain-grown crops planted during December and January. Trials against this pest set out early in the season were not infested: later in the year, in the absence of others more suitable for the purpose, leaf miner was used in dosage/volume investigations. There was an increase in the number of reports of mite infestations (other than eriophyids) from several districts. As a precautionary measure, miticide taint trials were carried out at Dimbulah and Inglewood. Work was continued at Millaroo on the correlation of seedbed treatments and ultimate crop yield, and the importance of the correct time interval between EDB fumigation and planting was demonstrated in a trial at Inglewood.

Some years ago, although lead arsenate was no longer necessary for immediate commercial use, technical studies with this material were continued as one phase of acquired resistance work. More recent developments include plans for the routine checking of all materials officially recommended for the control of major tobacco pests.

FORESTRY

Ratings were continued in the bagworm (*Hyalarcta hubneri* (Westw.)) parasite and population studies at Passchendaele. Further trials against the cedar shoot borer (*Hypsipyla robusta* (Moore)) have been established in the Mary Valley. Fumigation of imported houses infected by the European house borer (*Hyloirupes bajulus* L.) has been completed. The volume of routine identifications of insects infesting timber continues at an appreciable level.

NEMATODES

In addition to investigations mentioned elsewhere in this report, a State-wide scheme for collecting nematode material for study was implemented. A technical paper on the control of the strawberry nematode (*Meloidogyne hapla* Chitwood) has been prepared for publication. Further glasshouse and laboratory facilities are required for nematode research, and arrangements for these are being made.

PASTURES

Pastures generally were in good condition, and damage by white grubs (*Lepidiota caudata* Blkb.), the grass grub (*Onocopera mitocera* (Turn.)) and the grass caterpillar (*Psara licarsialis* (Walk.)) were of a minor nature only. Large field trials concerned with the controls of white grubs and funnel ants (*Aphaenogaster* species) through grass species and farm management have been set out on the Atherton Tableland. The problem of controlling seed-harvesting ants in western pastures is now at the stage of planning the establishment of some 60 acres of trials during the coming summer.

VEGETABLES

The main difficulties encountered in the control of vegetable pests were in out-of-season crops; the tomato mite (*Vasates lycopersici* (Masse)) on tomatoes at Rockhampton during summer was an example. *Gnorimoschema operculella* was again active in tomatoes at Stanthorpe. Results of insecticide screening trials in cabbages and beans demonstrated the soundness of current recommendations, and that in future insecticide trials phytotoxicity will require more attention. Apparently in preparing some of the newer insecticides difficulties in formulation have been encountered and to some extent solved: the problems of residues and phytotoxicity under Queensland conditions, however, have been increased. This state of affairs is not confined to work with vegetables.

COTTON

Rough bollworm (*Earias huegeli* Rog.) destroyed many bolls and squares in Lower Burdekin cotton fields, and the pink bollworm (*Pectinophora scutigera* (Hold.)) was present as small populations in irrigated crops at Biloela as early as December. In the Central Districts a heavy programme of research on cotton pests was continued, with emphasis on the pest status of the insect species and the relationship between plant behaviour and crop yield reductions which may be due to injury by insect attacks. Outstandingly high yields due to fertilizers, and the presence of some of the insect species in moderate to high numbers, contributed to the success of the work in irrigated trials. Similar investigations were commenced in northern areas, and plans are well ahead to study cotton pests under a still wider range of climatic and agronomic conditions. For the first time in many years, technical and extension articles on cotton pests in Queensland were published.

MISCELLANEOUS FIELD CROPS

The tuber moth (*Gnorimoschema operculella*) was active in some potato crops in the Lower Burdekin district, but was not serious in the spring crops in the Lockyer Valley. The blue oat mite (*Penthaleus major* (Duges)) in barley was the most prevalent pest on the Darling Downs. On the Central Highlands most linseed flowered early and *Heliothis* species were of little importance: on the Darling Downs these pests were not severe and where chemical control was required one spraying usually gave satisfactory results. In DDT levels trials, under the favourable conditions experienced adequate protection was obtained with surprisingly low dosage rates. Cutworms and armyworms were not common, although some isolated instances of damage were recorded.

The sorghum midge (*Contarinia sorghicola* (Coq.)) was prevalent only in crops flowering during wet weather in January and February. An account of several years' work with this insect has been compiled in thesis form, but so far only a few minor portions have been published. The leaf roller (*Tortrix divulsana* (Walk.)) was active in lucerne during October in the Lockyer Valley, and at Gracemere, where spraying was somewhat ineffective until white oil was added to the DDD. Data from trials against the false wireworm (*Gonocephalum* sp.) show that a reasonable commercial control of this sporadic pest is a distinct possibility. The aphid (*Capitophorus elaeagni* (Del Guer.)) was prevalent on safflower and caused concern to growers. There is some doubt as to whether this insect causes damage when soil moisture is adequate for sustained plant growth. Work on the control of the seed-harvesting ant (*Pheidole amplifera* Forel.) in cereal crops was accelerated. Further large-scale field trials were undertaken, and germination tests were extended to cover a wide range of seed. A seed dressing was recommended for commercial use, and has proved efficacious.

MISCELLANEOUS

Studies on Coccoidea, Agromyzidae, Dactyniinae (systematics and cytology), Thysanoptera, Aphididae, Acaridea, scarabaeoid larvae, and *Heliothis* species have been continued, and numerous articles have been either published or prepared for publication.

The most interesting of many new mite records for the State is citrus red mite (*Panonychus mori* Yokohama) in North Queensland. Field investigations on the mite problem (three species involved) in strawberries has been concluded for the present. During the past season trials established were carried through thoroughly, and large yield increases were obtained by the use of materials such as Kelthane and sulphur. Leaf miner (*Gnorimoschema operculella*) heavily mined the leaves of egg plants at Ayr. White-ants damaged and faulted several miles of plastic sheathed telephone cable in south-eastern Queensland. On the Darling Downs, congregating mice (*Mus musculus* L.) were troublesome.

BEEKEEPING

Poor conditions for beekeeping during the second half of 1958 were a direct result of the 1957 drought, and generally honey flows were not heavy. The whole season was largely a period of recovery. Extension work covered 3,005 colonies in 76 apiaries in 22 localities. Extension services were increased in the Rockhampton, Townsville and Atherton districts.

At Mar. 31, 1959, the end of the beekeeping year, 1,319 beekeepers were registered. This is an increase of 316 over those for the previous year, and is the highest number recorded under legislation.

The Honey Flora of South-Eastern Queensland was made available during the year as a book.

FLORA AND FAUNA CONSERVATION

By the end of the marsupial year (Dec. 31), 1,504 permits and licenses had been issued under "The Fauna Conservation Act of 1952." During the year 26 honorary protectors were appointed and 11 prosecutions for breaches of conservation and protection Acts were recorded.

Information about sanctuaries is being published through the *Queensland Agricultural Journal* and the preparation of material and maps continues. As the next logical step, field surveys of sanctuaries have been initiated, and the first of a series of descriptive articles has been prepared for publication. Routine data on the marsupial skin industry continue to receive attention. An officer with some Queensland field experience has been given the assignment of studying marsupials, and plans for obtaining the required equipment and further suitable training at universities outside the State are being implemented.

Wild duck investigations are advancing steadily. Banding continues, a net-work of observers (Department officers) is being organised, management areas are receiving attention, and several zoological studies have been started. Some relevant technical articles are being prepared for publication. During the open season for specified duck species usually only small "bags" could be obtained.

PLANT PATHOLOGY SECTION

A changing pattern is evident in the field of plant pathology in Queensland. A few years ago the accent was on chemical control of plant diseases. This was prompted by the development and distribution of large numbers of new organic fungicides which required testing in the field under local conditions.

While fungicidal work is still being carried out, more emphasis is now being placed on disease resistance and avoidance. Work is also being conducted on etiology and conditions contributing to the development of particular plant diseases. This latter field, besides providing the background knowledge for the control of diseases by resistance or cultural means, is also an essential preliminary to satisfactory experimentation on chemical control.

CEREALS

On the Darling Downs the event of outstanding importance was the appearance in 1958 of a new physiologic race of wheat stem rust, which has changed completely the pattern of acceptable varieties. In a favourable season for its activity the new race demonstrated a marked ability to mature successive heavy crops of spores and heavy losses to the crop resulted. Gabo, Charter, Puora, Koda and Seafoam are particularly susceptible, and of the commercial varieties, only Spica, Lawrence and Festival show good resistance.

The season was conspicuous again for the high incidence of frost damage in all cereals, and crown rot (*Fusarium graminearum*) infection in wheat was commonly associated with this type of injury. Comparisons have been made in the glass-house of various techniques for obtaining crown rot inoculation with a view to studying under controlled conditions the effect of environmental factors on the severity of this disease.

Noteworthy also was the high incidence of smut in prairie grass (*Bromus catharticus*), caused by *Ustilago bullata*. In view of the observed proneness of prairie grass to organic mercury injury, the present recommendation for controlling this disease by mercurial seed treatment is being re-examined.

Further studies have been made in the field and in the glasshouse on the method of infection of covered kernel smut (*Sphacelotheca sorghi*) of sorghum and the effect of such factors as depth of planting, soil texture and density of inoculum on the extent of infection and subsequent effect on the host. There appears to be a close association between soil nitrogen and the degree of expression of sorghum smut.

During the past summer in North Queensland maize rust assumed epidemic proportions and heavy losses were sustained. This outbreak presented features differing from those normally experienced in Queensland and consideration is being given to the question of whether this epidemic represents a more virulent attack by the normal Queensland maize rust (*Puccinia sorghi*), as morphological characters suggest, or whether it is due to a new introduction.

PEANUTS

Work on the control of crown rot (*Aspergillus niger*) in peanuts was continued and during the season four field trials were planted with this object in view. The results were similar to those obtained the previous year and confirmed the superiority of a seed dressing consisting of a mixture of an organo-mercurial compound and captan.

Leaf spot, caused in the main by *Cercospora arachidicola*, proved troublesome in some areas, causing premature leaf fall. The incidence of this disease has, however, been sporadic and conditions such as lack of air drainage and poor growing conditions appear to have favoured its occurrence. It is difficult to imagine that fungicides will ever be used extensively to control this disease because of the difficulty of forecasting probable severity.

Stem rot caused by *Sclerotium rolfsii* was of widespread occurrence but serious losses were not numerous. The primary effect of the disease is to cause the peanuts to rot off the peg, leaving them in the ground at pulling time. Leaf fall following leaf spot accentuates the damage and the mycelium of *S. rolfsii* could be seen growing throughout the fallen leaves at the base of the plant. In a field trial comparing the effect of hilling, not hilling and treatment with pentachloronitrobenzene, the yields were slightly in favour of the use of P.C.N.B. The economics of this method of control would need careful consideration.

TOBACCO

In North Queensland, owing to the absence of the usual rain group towards the end of the growing period, a blue mould epidemic failed to eventuate. Mould early became widespread but the intensity of infection was low and leaf loss was on the whole light. These conditions militated against the main fungicide field trial in which zineb plus methyl salicylate plus cottonseed oil at one and two applications per week was compared with zineb plus a spreader only.

Because of the low intensity of infection the reduction in leaf mould damage was not particularly striking, nor was it possible to determine whether the additives made any difference to the loss in efficiency associated with zineb alone under epidemic conditions. However, the combination spray at both schedules reduced stem mould infection to negligible proportions and was definitely superior to zineb alone for leaf mould control. Leaf which had been consistently sprayed with the zineb-cottonseed oil-methyl salicylate mixture broke down on curing and it becomes necessary to investigate this aspect of the problem further.

In a seedbed experiment designed to clear up the question of rate of benzol application there were no obvious differences in either leaf mould or stem mould infection in plants derived from seedlings fumigated with 1 sq. in. of benzol per sq. ft. every second night or every third night. Seedlings treated every second night were more stunted and distorted but this disadvantage was quickly overcome when the plants were transferred to the field.

Following a proposal made by the Queensland Tobacco Advisory Committee, a comprehensive survey of tobacco crops in North Queensland was carried out during the course of the 1958 season with the object of determining the conditions contributing to blue mould development. In the absence of the usual epiphytotic, which it is well known can drastically alter the final blue mould picture, it would be premature to place too much emphasis on the results from this one survey. However, much useful information was obtained.

Volunteer plants and root suckers were found to be numerous in all the major tobacco areas visited and on these blue mould was observed prior to the planting of seedbeds. This provides a source of infection which can accelerate the development of mould in the crop by several weeks. Existing recommendations for seedbed management were adequate when properly applied, but many growers were committing the fault of discontinuing the use of benzol several days before planting out.

The influence of such factors as isolation, time of planting and method of watering will be better reviewed in the light of a further survey which is being carried out in 1959.

GINGER

At Nambour a ginger rhizome rot experiment was concluded. Various dilutions and times of immersion of a standard mercurial containing 6 per cent. mercury were compared as a seed-piece dip. Increasing concentration and time of immersion gave better control of rhizome rot (*Fusarium oxysporum*) up to the point where abnormal shooting occurred. The best combination to use is probably 2 lb. in 40 gal. for 10 min. This will speed up operations compared with the present recommendation of a 30-min. dip using half this strength.

STONE FRUITS

In Stanthorpe, two brown rot (*Sclerotinia fructicola*) experiments were concluded. It would appear from a spraying trial that fortnightly or weekly sprays of captan over the month prior to harvest and ending with one immediately prior to picking will reduce the rot very considerably. A time-of-infection experiment involving bagging fruit at various stages in their development proved somewhat inconclusive, but as in previous years the general indication was that in Queensland most infection takes place during the ripening period.

STRAWBERRY

Phenomenal strawberry plants with no obvious symptoms of virus disease were tested by making petiole grafts on to *Fragaria vesca*. Many of these were found to be carrying a virus which produced severe symptoms on the latter. The plants which produced no symptoms in the transfers have been multiplied, and after re-testing the survivors will be used as the nucleus of a virus-free runner scheme.

A species of *Gloeosporium* isolated from strawberry flowers was shown capable of infecting the stigmas and preventing fertilization. With a heavy artificial infection the flowers were killed. Lesser infections damaged the flowers and resulted in fruit malformation. Work on the chemical control of this organism, which is also responsible for an important fruit rot, is proceeding.

BANANA

Following the demonstration of the efficiency of oil sprays for the control of leaf spot (*Cercospora musae*), an attempt was made to ascertain the part played by the oil in this control. White oil emulsion in itself is not toxic to the fungus, yet applications to the leaf either before or after inoculation will prevent infection. A field trial is under way to decide the usefulness of misting and fogging techniques for leaf spot and speckle control under northern conditions.

After many years the pathogenicity of the fungus which has been associated with the cause of leaf speckle in bananas in Queensland has been satisfactorily proven. This organism is a *Mycosphaerella*, probably *M. musae* (Speg.) Sydow. The control of this disease has been investigated in conjunction with the work on leaf spot. Oil alone is not as efficient a fungicide with speckle as it is with the latter. Moreover, more attention has to be given to maintaining a cover on the older leaves of the plant if adequate control of leaf speckle is to be obtained.

VEGETABLES

Two French bean trials were conducted at Redlands Experiment Station during the year. The present object of this work is to add resistance to angular leaf spot to the multiple disease resistance of the already released Redlands Beauty variety. A number of promising progenies have been selected which will receive a more intensive screening for anthracnose and mosaic resistance in the glass-house.

The second of these bean trials was severely affected by *Sclerotinia* rot, and this made possible an assessment of the response of the different lines to this particular hazard. This was the first time for some years that a good infection with *Sclerotinia* had been obtained, with the result that many of the lines had to be discarded for showing a susceptibility as great or greater than Brown Beauty. Fortunately the 8-1A and 121-2-3 types on which the work is now concentrated withstood *Sclerotinia* fairly well.

The search for a source of resistance to leaf shrivel disease of tomatoes continues. A large number of wild tomato accessions imported through the C.S.I.R.O. Plant Introduction Service have been tested for susceptibility to leaf shrivel and mosaic in the glasshouse and the field. In the spring field trial at the Redlands Experiment Station two lines withstood both diseases well but are poor breeding material because of extremely low yields and miniature fruit. Two others of better quality withstood leaf shrivel but were badly affected by mosaic.

A spring planting of tomatoes at Redlands was devoted to Fusarium wilt resistance. The object was to examine the potentialities of some new wilt-resistant accessions and by selection to maintain or improve the resistance in some of the standard varieties. Glasshouse testing of each succeeding generation is also part of this work.

PASTURES

The summer death of red clover is a common occurrence in irrigated pastures in Queensland. *Rhizoctonia solani* is often isolated from the crowns and roots of affected plants. In glasshouse pathogenicity tests it has stunted and killed red clover during warm weather but with cooler temperatures the surviving plants grow vigorously. This closely resembles the field performance. Rugose leaf curl virus, anthracnose (*Colletotrichum trifolii*) and crown rot (*Sclerotium rolfsii*) were also found to be damaging red clover.

The occurrence of rugose leaf curl on white clover has been a matter of observation for a number of years. Except for one or two serious outbreaks this virus disease has caused no noteworthy deterioration of white clover pasture.

FORESTRY

Phytophthora cinnamomi was found to be associated with a root rot of *Pinus* trees at Beerburrum in 1957. This fungus has since caused severe root rot and death of *Pinus* seedlings at Passchendaele and Toolara forestry nurseries. A systematic soil and root isolation survey was subsequently carried out in the major *Pinus* nurseries of southern Queensland. *P. cinnamomi* was not located in nurseries other than the two mentioned above but several species of *Pythium* were associated with a root necrosis.

Initial pathogenicity tests have shown that *Phytophthora cinnamomi*, *Pythium ultimum* and *Rhizoctonia solani* are capable of causing damping-off in seedlings of *Pinus radiata*. Further tests using other species of *Pythium* and also larger plants are proceeding.

More definite evidence has been obtained of the pathogenicity of the fungus commonly associated with root and butt rot of hoop pine and other rain-forest trees in North Queensland and the solution to this long outstanding problem appears more promising.

MICROBIOLOGY

The legume inoculum service has increased steadily each season. Record numbers of cultures for cowpea and lucerne were sent out for the spring, summer and autumn plantings. Inoculum distribution centres are now firmly established at Gympie, Warwick, Toowoomba, Cooroy, Kingaroy and Atherton, while at Emerald and Rockhampton increasing use is being made of this service.

With the prospect of increased planting of soybean on the Downs and in the Kingaroy district a Rhizobium strain trial including strains from overseas and local isolates from soybean and from a native species of *Glycine* is being carried out to ensure maximum benefit from inoculation.

Temperature studies on the survival of Rhizobium on inoculated seed in the soil have been continued. Laboratory experiments have been carried out to determine the survival rate of different strains in wallum sand held at 40 deg. C. No strains survived 24 hours at this temperature but those selected for possessing a higher maximum survived longer. Higher concentrations survived proportionately longer than lower concentrations. The knowledge gained will have a practical application in the field.

A number of new or interesting recordings were made during the year. Some of those which might be mentioned are: Crown and root rot of lucerne (*Phytophthora parasitica*); passion fruit root rot (*Phytophthora parasitica* and *P. cinnamomi*); Marasmium root rot of banana; leaf and pod spot of beans (*Pleiochaeta setosa*); big vein of lettuce (*Olpidium brassicae*); corn rot of gladiolus (*Curvularia lunata*); *Cylindrocladium scoparium* on roses; fruit rot of rockmelons (*Mycosphaerella melonis*); bacterial wilt of French bean (*Pseudomonas solanacearum*); and bacterial fruit spot of pumpkin (*Xanthomonas cucurbitae*).

Some wild

Am. 1. 10. 1957

CHEMICAL LABORATORY

Owing to the great demand for chemical data in studying crop and pasture production problems, the chemist must be brought more and more in contact with problems in the field. With this idea in mind the establishment of subsidiary laboratories in the country was begun some years ago, and this has already proved to have been a sound procedure.

During the year the Northgate Tobacco Research laboratory, formerly administered by the Agriculture Branch, was attached to the Chemical Laboratory. This laboratory is located on the selling floor of the South Queensland Tobacco Growers' Co-operative Association at Northgate and has a valuable function in examining tobacco leaf quality in relation to marketing problems.

As staff and facilities become available it is hoped to establish additional laboratories devoted to other aspects of primary production in the country. Plans have already been completed for a well-equipped laboratory at Mareeba, the centre of the Mareeba-Dimbulah irrigation project. Chemists will thus have facilities to assist in solving soil, water and plant inter-relationship problems associated with irrigated crops in this area. Many results from the work will apply in other districts where crops are grown under irrigation.

A rapidly expanding section of the Brisbane laboratory is that concerned with general analytical problems, including those of pest destroyers, veterinary medicines and other agricultural requirements. The vast increase in the number of complex organic formulations reaching the market in recent times demands the highest efficiency on the part of the research analyst. Only by the adoption of the latest techniques and the use of electronic equipment is he able to keep abreast of modern developments.

The work of the three sections of the Chemical Laboratory covers a large field of research as well as providing services to other Branches of the Department. Details of the more important projects will be found in the reports of these sections.

PLANT NUTRITION SECTION

Investigational work to obtain further data relating to the movement of applied soluble fertilizers in the red clay loam at Redlands Experiment Station was continued during the year in co-operation with the Horticulture Branch.

A field trial with strawberries showed that a significant response both in weight and in number of marketable fruit was obtained from a basal dressing of superphosphate at the rate of 455 lb. per acre. There were also responses to side-dressings of sulphate of ammonia up to 195 lb. per acre and to superphosphate at 182 lb. per acre.

Soil samples taken at 3 in. intervals to a depth of 24 in. two days before the side-dressing applications and 10 days later showed that nitrate levels were of a low order (1.2 p.p.m. N) in the nil nitrogen plots throughout the duration of the experiment and phosphorus and potassium applied as side-dressings did not move below the 6 in. layer.

No response to potassium was obtained in this experiment, and as the soil contains 0.30 m. e. K per 100 g. soil it would seem that this level is adequate on this soil type for the growth of strawberries.

Soil Salinity Studies

Investigational work on saline soils at Currumbin, a joint project with the Agriculture Branch, was continued during the year. In previous years surface drainage and the application of large amounts of mill mud had resulted in a decided improvement of the sown pastures but drainage was still unsatisfactory.

During the year an attempt was made to improve the drainage with the use of a mole plough. Mole drains were put in at 12-14 in. below the surface, at which depth a highly solonized impervious clay with columnar structure occurs. The effectiveness of the mole drains was demonstrated markedly following a rainfall of 18 in. late in March. It was possible to move tillage imple-

ments on to the mole-drained area several weeks in advance of the surface-drained portions. Comparative figures for chlorides in the surface soil are shown in Table 1.

TABLE 1
SOIL CHLORIDES—PARTS PER MILLION

Sampling Date	Untreated	Surface drained	Mole drained
3rd November, 1956	1,888	2,300	4,505*
17th March, 1959	998	1,585	937
28th April, 1959	1,368	1,503	745

* Before mole-draining.

In one wet season, the chloride level in the mole-drained area was reduced to approximately half that achieved by surface drainage over a 4-year period. This area was planted to a mixture of Wimmera ryegrass and Priebe's prairie as the main grasses and Ladino white clover as the legume on April 13. By June 12 an excellent stand of both grasses and legume was in evidence. It would seem that this method of soil amelioration could have application in other badly drained and salted areas of similar type.

Zinc Deficiency in Linseed

As previous experiments had shown that the time of application of zinc sprays was important, zinc sulphate and zinc chelate sprays were applied to linseed plants in a new experiment at Brookstead when the plants were two weeks old and again when they were five weeks old. Although definite trends in favour of spraying at the younger growth period were evident, the variation in yield between the various small plots was too great for significance to be proved.

This experiment, somewhat modified, has been repeated at Mt. Tyson as a co-operative project with the Agriculture Branch, using much larger plots which permit the use of normal field harvesting equipment. Applications of zinc sulphate spray and powdered zinc metal will be applied to the seedlings at emergence and at several subsequent periods.

Urea Application to Wheat

In this trial at Pampas, a co-operative one with the Agriculture Branch, 240 soil samples were analysed for nitrate content and quality tests were carried out on the harvested wheat. Nitrate concentration in the surface 8 in. of soil fluctuated appreciably according to the rainfall and rate of plant growth. Average values for nitrates for the three years in the untreated plots were as follows:—

Depth in.	Soil nitrates—p.p.m.N.
0-4	4.1
4-8	7.2
8-12	6.3
At 24	3.6
At 36	1.3

The nitrate content decreased generally with depth from the 4-8 in. horizon, the proportional decreases being practically the same from year to year.

Application of urea increased appreciably the protein content of the wheat but did little to improve the baking quality of the flour.

Soil Survey

No detailed field work was undertaken during the first part of the financial year but a start was made in May on a survey of the Emerald Creek section. Reports of the Walkamin-Mareeba and Left Bank Atherton Creek areas, the field work of which had been done the previous year, were finalized and presented. The former section consists of 12,000 acres, of which approximately 10,000 were mapped; the remainder was broken country. Approximately 5,500 acres were classed as suitable for perennial and annual crops, excluding tobacco, and 2,900 acres for annual crops only (excluding tobacco). Most of the soils are derived from basaltic material and for that reason are not

favoured for tobacco culture; only 81 acres of the entire area were classed as suitable for tobacco, although an additional 300 acres could probably be used if special irrigation techniques were employed. Certain soils would require artificial drainage before satisfactory crops could be grown on them.

The Left Bank Atherton Creek section covers 4,500 acres. Of this total, 3,000 acres consist of creeks, gullies, and skeletal soils unsuitable for agriculture. Four hundred acres were classed as suitable for perennial and annual crops, including tobacco, with another possible 710 acres which would require special treatment in the application of irrigation water. A further 200 acres were considered suitable for annual crops but doubtful for tobacco because of the basaltic origin of the soils, and 310 acres could only be used for plants tolerant to waterlogged conditions.

Analytical figures of the soils showed very similar trends to those of several other sections which were examined previously in connection with the Mareeba-Dimbulah irrigation scheme. The more sandy types are generally of low fertility and many of the heavier soils are highly solonized.

Routine Analyses

Routine analyses of the Brisbane laboratory included 3,826 soil samples and 907 waters. Of the soil samples, 1,553 were in connection with various experimental projects, the remainder being samples submitted by farmers as a general check on soil fertility or in connection with plant failure thought to be associated with some plant food deficiency. In addition to the reports submitted in connection with the 907 waters analysed during the year, an additional 1,226 waters which were analysed by the Government Analyst were assessed as to their suitability for irrigation and/or stock for the Irrigation and Water Supply Commission.

Tobacco Research

Much of the equipment needed to analyse tobacco leaf for its major constituents is now installed at the Northgate Tobacco Research Laboratory. This laboratory is staffed by a chemist and two assistants, whose basic task has been a survey of leaf marketed in South Queensland, with particular emphasis on the chlorine content as it affects quality and burn.

Leaf marketed in 1958 showed a generally higher level of chlorine than that sold in 1957. The earlier crop had been influenced by the heavy floods which occurred in the Macintyre and Dumaresq Rivers early in 1956.

During the year, 373 samples of tobacco leaf were analysed, as well as 283 soils and 40 waters. The soils and waters were examined to determine their suitability or otherwise for tobacco production.

Wallum Investigations

Two legumes which have performed well at the Coolool Field Station are centro and stylo. From the results of previous trials it would appear that the nutritional requirements of centro are of a much higher order than those of stylo, and with the idea of determining the optimum rates of application of dolomite, phosphorus and potassium to these plants, 3 x 3 x 3 trials have been established on the Field Station.

Experiments with vegetative plantings of centro in the early summer period, when it is particularly difficult to establish this legume from seed, proved to be most successful.

An area of pangola grass was planted with rooted pieces of centro in November and these have made good growth. This mixture of pangola grass and centro would seem to have distinct possibilities for the wallum country. Plantings of centro by seed which were carried out last year in rows of established grasses and which are now doing well are those associated with paspalum and with molasses grass. The rows of centro were given additional quantities of superphosphate and potash to those received by the grass.

An area of established centro-summer grass mixtures which consisted of adjacent plots of molasses grass, paspalum, Biloela buffel grass and green panic in associa-

tion with centro was grazed heavily in the early summer to see how the respective mixtures regenerated after a spell. All plots came away well following the summer rains, the two mixtures showing most promise being molasses-centro and paspalum-centro. All plots were grazed again in early June for observational purposes.

The main pasture areas on the Station are only receiving light grazing at the present time, as an endeavour is being made to establish additional legumes in them.

Observation plots of bananas planted in the forest type of country, after a poor start due to the drought period in 1957, are now looking much more promising. The Mons Mari variety, which was almost a complete failure when planted originally, has now produced much stronger followers and is showing distinct promise.

The citrus trees planted several years ago are looking well and some good quality fruit is being produced. Leaf symptoms suggesting deficiencies of copper, zinc, boron and manganese have been noticed from time to time but have been corrected by spraying with solutions of appropriate trace elements.

The observation pineapple blocks on both the forest area and bedded-up heath soil are looking well and should produce good quality fruit for next summer's pack.

GENERAL ANALYTICAL SECTION

The General Analytical Section examined 2,149 samples during the year, comprising:—

Grasses and legumes	1,279
Stock foods	387
Pesticides, fungicides, &c.	171
Fertilizers	90
Veterinary medicines	26
Miscellaneous	196
	2,149

The samples of grasses and legumes were mostly from various field trials or observation plots. A joint project with the Agriculture Branch involving a study of the carbohydrate content of buffel grass and green panic continued during the year at Brian Pastures Research Station and is expected to proceed for another six months before final results can be examined. In all, 329 samples have been analysed in connection with this investigation.

A large proportion of the samples of stock foods, pesticides, etc. were submitted by the Standards Branch to determine their conformity with the Agricultural Standards Act. The standard of fertilizers and veterinary medicines was satisfactory but a number of stock foods and pest destroyers were found to be in error. Of the stock foods, 14 per cent. were found to be below standard in some constituent, usually protein, and of the pest destroyers, 16 per cent. did not conform with the requirements of the Act.

Work on Linseed

Experiments continued with linseed samples to correlate the iodine value and refractive index measurements of extracted linseed oil. The Standards Associa-

TABLE 2
ANALYSES OF LINSEED SAMPLES—HERMITAGE

Name	Oil	Iodine No.	Refractive Index at 25°C.
	per cent.		
Walsh	35.74	167.6	1.47825
Walsh	34.81	169.45	1.4782
Plate (Q2916)	34.95	165.2	1.47775
Hazel Bean (Q3879)	36.60	168.3	1.4779
Calar (Q2918)	36.51	169.1	1.4780
Viking (C.S.I.R.O.)	37.0	183.8	1.4797
Redwood (Q3209)	37.84	181.5	1.4796
Bolley Golden 5000	36.85	188.85	1.4802
Zona Buenos Aires (Q2915)	36.76	169.2	1.4780
Marine (Q3210)	36.15	188.5	1.4802
Newland (C.S.I.R.O.)	37.12	186.46	1.4800
Uruguay (Q2917)	37.69	167.6	1.4777
Dakota (Q3020)	36.99	185.24	1.4795
Royal (Q3010)	37.59	176.86	1.4784
Malabrigo (C.S.I.R.O.)	35.46	169.04	1.4776
Rio 5000	37.51	167.82	1.4774
Bolley Golden 4907	37.44	185.94	1.4795
Victory (Q3215)	36.98	178.66	1.4787

tion of Australia specification for "pressed" raw linseed oil provides a minimum iodine value of 177 and a refractive index of 1.4785. It will be seen from the results in Table 2 that a number of the linseed samples from Hermitage have iodine values of less than 177 and in all these cases the corresponding refractive index

TABLE 3
ANALYSES OF LINSEED SAMPLES—ALLORA

Name	Oil	Iodine No.	Refractive Index at 25°C.
	per cent.		
Rio	40.84	180.5	1.4797
Viking	40.21	188.05	1.4804
Plate	39.54	178.6	1.4791
Calar	41.0	181.1	1.4796
Newland	39.60	185.5	1.4800
Zona Beunos Aires	40.95	182.25	1.4798
Redwood	40.70	183.9	1.4799
Walsh	40.26	181.1	1.4795
Hazeldean	41.11	183.2	1.4796

figures are less than 1.4785. All samples from Allora (Table 3) gave higher values than 177 and 1.4785 for iodine value and refractive index respectively. It is hoped to make arrangements with an oil-pressing firm to provide samples of "pressed" oil so that a similar series of figures may be compared.

A further set of 60 samples is awaiting analysis.

Miscellaneous Samples

These included several interesting samples for analysis. One, a by-product of the peanut industry, was submitted for a determination of its stock food value. It consisted of the seed coat and broken nut pieces. It had the following composition: moisture 7.2 per cent., protein 17.2 per cent., fat 19.8 per cent., carbohydrates 40.6 per cent., fibre 12.6 per cent., ash 2.6 per cent., lime (CaO) 0.25 per cent. and phosphoric acid (P₂O₅) 0.40 per cent. It is interesting to note the high amount of fat which remains in the seed coat. This figure is in accord with a previous analysis of similar material. A sample of Johnson grass roots and underground rhizomes was also submitted for a determination of its stock food value, as large amounts were apparently available in certain areas where Johnson grass had been ploughed out. It contained 7.6 per cent. protein and only 17.6 per cent. fibre and so would form a reasonable stock food. Unfortunately, it contained 39.3 mg. of hydrogen cyanide per 100 g. of green plant and for that reason would need to be used with care.

CEREAL SECTION

Protein Survey

The mean protein value of 151 samples received from the Wheat Board was 13.1 per cent. Values for individual varieties are shown in Table 4:—

TABLE 4
RESULTS OF WHEAT PROTEIN SURVEY

Variety	Protein (mean)	Protein Range	No of Samples
	per cent.	per cent.	
Gabo	12.3	9.4-15.8	24
Festival	14.1	12.0-17.8	49
Charter	13.3	11.3-15.3	11
Seafoam	12.4	10.8-14.6	14
Spica	13.9	11.0-16.5	27
Miscellaneous	11.7	9.8-15.4	26

Bushel of Wheat Competition

This annual competition run by the Royal Agricultural Society, Toowoomba, attracted 143 entries (122 last year). The mean protein content was 13.1 per cent. (13.7 per cent. last year).

The following are the results of the competition:—

Champion	Koda	196 marks
Reserve Champion	Gabo	192 marks
Strong wheat class, 1st	Charter	186 marks
Strong wheat class, 2nd	Puora	183 marks
Medium strong class, 1st	Koda	196 marks
Medium strong class, 2nd	Gabo	192 marks

The maximum possible number of marks was 210. The winning entry was a sample of Koda with a record protein value of 18.4 per cent. and a bushel weight of 64½ lb. It is interesting to note that most of the Koda entries provided strong competition.

Co-operative Work

Plant Breeders' Samples.—An important part of the Cereal Section's work is the checking of the quality of new varieties produced by the plant breeder. The following comments are made on wheat varieties:—

(1) *Late-maturing Varieties.*—All samples were high in protein, but flours were of the medium strong class, with the exception of Sabre which was very strong but had an undesirable type of protein. The best sample was TV₅TT5575. Lawrence, HSPFSH5016, WCH 5316, and CHFEG4403 were all good.

(2) *Mid-season Varieties.*—All wheats contained high protein and had good baking quality; Koda was exceptionally good. Charter, Festival, LG5391 and Koda were strong and the remainder medium strong. LG5391 was very strong but had an undesirable type of protein. KFD₅K₅4614 was very good (Lawrence type), LG5387 good, but KFD₅K₅4623 only fair.

(3) *Early-maturing Varieties.*—Again all wheats contained high protein and produced strong to very strong flours. Very good samples were LG5390, SHSW4610, SHPFSH5362, Gabo and Spica. Samples of PRA₅K₅5556, PRA₅5566, Puora, PRA₅ARG5547 and SFM₅MENT5579 all had undesirable types of protein.

Additional studies with the Agriculture Branch were in connection with (a) a stubble nitrogen trial, (b) a survey of the quality of wheat grown in brigalow soils, and (c) a urea time-of-application trial.

In both (a) and (c) protein percentages were increased appreciably by the application of nitrogen but the baking quality of the flour was not necessarily improved. All samples submitted from brigalow soils were high in protein and gave moderately low bushel weights.

Joint studies with the Regional Experiment Stations Branch were in connection with the following trials—(a) variety, (b) an 8-year cycle rotation, (c) fallow, (d) time-of-planting and (e) standard variety. Trials (a) and (b) were at Hermitage and (c), (d) and (e) at Biloela.

Both trials at Hermitage produced wheats of good baking quality. In the fallow trial at Biloela the long-fallow system produced the strongest wheat but this had certain undesirable mixing qualities for machine baking methods. Planting in July in the time-of-planting trial produced a very high quality product. In the standard variety trial good quality samples were of Gabo K₅S4604 and Kenora; fair samples those of Pusa 4, Seafoam, LXG and Spica; and poor samples those of Puno and KGPF4521.

Chemical Research Projects

Chemical studies which involved the isolation of starch and protein from the varieties Spica and Festival were undertaken during the year. In these experiments the normal flour from each variety was diluted with added quantities of starch on the one hand and protein on the other and the reconstituted flours were then tested for quality on the physical testing machines.

These studies are incomplete but it can be stated at this stage that additions of starch from Spica gave a more extensible and stronger flour than did similar additions of starch from Festival. Flours to which gluten had been added produced farinographs which were not normal.

DIVISION OF ANIMAL INDUSTRY

The Division of Animal Industry is made up of the following Branches:—Veterinary Services, Cattle Husbandry, Sheep and Wool, Pig and Poultry, Pathology, Biochemical and Husbandry Research. The first four Branches named are field or extension Branches and the remaining three research or laboratory Branches.

The line of demarcation between Branches, however, is not always clear-cut. As evidence of this it should be noted that some research work is carried on by all the field Branches and particularly by the Cattle Husbandry, Sheep and Wool and Pig and Poultry Branches. All three of these Branches have access to Regional, Field or Research Stations. The Poultry Section of the Pig and Poultry Branch indeed has a comparatively large, well-equipped poultry research and testing centre (at the Rocklea Animal Husbandry Research Farm) under its direct control. A similar situation exists in the case of the Sheep and Wool Branch, which directs the research programme in operation at the Toorak Sheep Field Station in the Julia Creek district. The position in the case of the Cattle Husbandry Branch is rather different, inasmuch as the Field (Brian Pastures and South Johnstone) and Regional Experiment (Kairi, Ayr and Biloela) Stations where it undertakes research work are not under the control of this Branch, or for that matter of the Division, being controlled by the Division of Plant Industry. Something similar obtains where the Pig Section of the Pig and Poultry Branch is concerned. The Section undertakes research work at the Kairi, Biloela and Hermitage Regional Experiment Stations. However, the Pig Section has a modern pig testing station at the Rocklea Animal Husbandry Research Farm under its direct control. Although the work done at this station is not research work in the ordinary sense of the term, it is special investigational work.

The three research Branches present the above picture in reverse, all spilling over into the area of a field Branch to some extent. This applies especially to the Biochemical Branch, which undertakes field research projects in conjunction with the field Branches, particularly Cattle Husbandry. The Pathology Branch undertakes field research projects in conjunction with the Veterinary Services Branch in particular, but also at times with the other field Branches. The Husbandry Research Branch might be expected to carry out field research or special investigational projects with all of the field Branches. In practice, however, collaboration has been largely restricted to Cattle Husbandry work. This to a large extent is due to the preoccupation of the Husbandry Research Branch with artificial breeding projects. On the other hand, there is very close collaboration between the Husbandry Research Branch and one of the other research Branches, viz. Biochemical.

It will be seen that there is a rather complex pattern of interests running through the Division. Attention is drawn to this specifically so that the reader will be aware of the necessity to look in more than one Branch report in order to be sure of getting all the information available on many subjects. The supplementary feeding of cattle, for example, figures prominently in the Husbandry Research, Cattle Husbandry and Biochemical Branch reports. Originally commenced as a straight-out research project in drought feeding of cattle, the scope of the work has been extended into the field and applied to the problem of preventing liveweight losses during the winter/spring period when the nutritional status of cattle on pasture is usually poor. Anyone who applies himself to the careful reading of the material on supplementary feeding in the three Branch reports mentioned can scarcely be left with any doubt that important work is under way; work that may ultimately have far-reaching effects.

CATTLE HUSBANDRY RESEARCH

Of importance to the cattle-man also is the record of work done at "Brian Pastures" as set out in the Cattle Husbandry Branch report. There is still a comparative dearth of factual information on what might be termed the vital statistics of the cattle industry. Certainly when what is available in respect of the sheep industry is taken into account, the unsatisfactory

position regarding the cattle industry is abundantly clear. Records accumulating as a result of the operations of the Cattle Husbandry Branch at "Brian Pastures" and elsewhere are helping, albeit in a small way, to correct this deficiency.

It is submitted that at "Brian Pastures" there is in progress a programme of work of unquestionable value to the cattle-man. Already several pointers have been obtained which if faithfully applied must surely bring dividends. There is, for example, the pointer to the advantages to be gained by feeding weaners as well as practicable from weaning until 18 months old, but for full details the Branch report is commended to the reader for perusal.

In this work at "Brian Pastures" the Division works in close co-operation with the Agriculture Branch of the Division of Plant Industry. The work, in fact, is in many respects a joint enterprise and the reader who is interested should not fail to read the section of the Agriculture Branch report that refers to "Brian Pastures." This is not the only example of collaboration between the two Branches and in truth it would be a considerable undertaking to set them all down at length. Suffice it to say that there is a clear realisation among those concerned that the soil-plant-animal relationship is one that repays critical analysis.

SHEEP STUDIES

In this regard it is pleasing to be able to report the commencement of joint work by the Sheep and Wool and Agriculture Branches at Toorak Sheep Field Station. The work envisaged must be viewed as a somewhat formidable undertaking. It will certainly be long-term in nature. Here again it is basically the soil-plant-animal relationship that is being studied; the difficulties arise by reason of the unfavourable environment. A concise statement of what is in mind will be found by reference to the Sheep and Wool Branch report.

As in the case of the Cattle Husbandry Branch and "Brian Pastures", records accumulating as a result of the operations of the Sheep and Wool Branch at "Toorak" are now commencing to add up to something of very real value. To the discerning reader this year's record of work done at "Toorak" will almost certainly appear as the best yet. A fairly clear picture of the reasons for low lamb-marking percentages in the area is emerging and the way may soon be open for a direct attack on the problem at the several points of the breeding cycle indicated in the report as being involved.

NEW DISEASE OF HORSES

The Pathology and Veterinary Services Branches have been much exercised with the investigation of an infectious disease of horses. The disease is caused by a virus and closely resembles equine infectious anaemia of horses, which has not been previously suspected of being present in Australia. The laboratory side of the investigation has perforce been carried out under great difficulties in temporary facilities that had to be provided with great haste. There is no small experimental animal that can be used when working with the E.I.A. virus. Horses are essential for the work, and as it must be carried out under conditions that permit of strict isolation (including insect proofing) the difficulties will be obvious enough.

The situation revealed by the necessity to investigate a virus disease like E.I.A. has highlighted a shortcoming in the facilities available at our Animal Research Institute at Yeerongpilly—a shortcoming that can be met effectively only by the expenditure of considerable funds. Our present deficiency is, however, not peculiar to this State.

Another serious aspect of the matter is the lack of any very clear understanding as to how the disease effected its entry into this country. It is difficult to believe that the outbreak in Central Queensland, some 150 miles from the coast and in a comparatively remote area, was the primary one. It could well be that the disease has been present in Queensland and possibly other States for some considerable time and gone unrecognised until it spread to a property where, conditions being especially suitable for it, cases occurred with some frequency.

IMPORTANCE OF DIAGNOSIS AND RESEARCH

The need for a well-equipped and fully staffed laboratory for diagnosis of and research on diseases affecting the livestock of Queensland is as real today as ever it was. There seems no end to the problem of disease, for as fast as a remedy or counter for one disease is found a new disease, or a new aspect of an old one, puts in an appearance. During the year under review the viral disease of horses referred to above, and the infectious diarrhoea (winter dysentery) of cattle referred to in the Pathology Branch and Veterinary Services Branch reports can be mentioned; also worm infestation of sheep under drought conditions in western Queensland as mentioned in the Sheep and Wool Branch report.

Equipment of suitable performance is now available in reasonable quantity at Yeerongpilly but laboratory space is sadly inadequate even though the staff is under the desirable strength in some sections. Each year the number of specimens submitted for laboratory examination increases and the need for a stable staff situation whereby a hard core of well-experienced and highly trained laboratory workers is continuously available becomes paramount.

The Institute has for many years already been justly well-known for the strength of its bacteriology section. It now, however, has a well-equipped histopathology and haematology section, the staff of which are highly regarded and making valuable contributions to the overall reputation of the Institute.

That section of the Institute's staff which is concerned with protozoology was strengthened during the year and is now active on the research side as well as diagnosis and immunisation. The programme of work relates chiefly to tick fever of cattle, as it has been obvious for some time that our knowledge of this disease is far from being as complete as is desirable. There was a period some 20 to 25 years ago when research in this field was quite active but of more recent years little has been taking place. It is pleasing therefore to be able to report that work has been resumed. It will be aimed at acquiring a better understanding of the mechanisms and development of immunity to tick fever and the detailed pathology of the disease.

In view of extensive outbreaks of cattle tick in "clean" country and heavy infestations in "marginal" country (as reported in the Veterinary Services Branch report) it is not surprising that tick fever was prevalent during the year. The resumption of research into tick fever referred to above is indeed timely.

VETERINARY SERVICES BRANCH

DISTRICT ABATTOIRS

Legislative provision was made to enable Local Abattoirs to be given approval to kill stock for consumption outside their abattoir area. They are now designated District Abattoirs. Toowoomba District Abattoir kills extensively for the interstate trade but is not yet licensed for export killing.

New District Abattoirs have commenced killing at Townsville and Ipswich and negotiations for establishment are proceeding at Rockhampton, Mackay, Maryborough and Gympie.

Facilities for country killing are being set up at Biloela and Murgon and enquiries are being made with respect to other centres. An additional killing facility has commenced operations at Dinmore. The Roma Abattoir is now conducted by a proprietary company.

The meatworks at Cape River, which previously slaughtered horses for export, has reopened as a centre for processing export beef.

PIGS AND POULTRY

The Pig and Poultry Branch was without the services of a Director virtually for the entire year. It is proving a difficult position to fill, largely by reason of the fact that not many graduates in Australia work in the field of either pig or poultry production and very few indeed have any extensive experience in both fields. In the meantime, the two Sections of the Branch are functioning under the supervision of their respective Senior Husbandry Officers with as much guidance as possible from the Divisional level.

The outstanding event recorded in the Pig Section report is the opening of the Department's modern pig testing station. This is a facility of the very highest order and such as may well be the means of bringing about substantial changes for the better in the pig industry. Its potential for improving the strain of pigs within breeds is undoubted and it is very satisfactory to be able to report that the industry has been quick to recognise this.

Of importance also was the introduction of a litter recording scheme. This is in many ways complementary to the work of the pig testing station.

The Pig Section report contains some information on diseases of pigs. This should be read in conjunction with material on the same subject in the Veterinary Services and the Pathology Branch reports.

The Poultry Section's activities during the year were more firmly tied to the State's Poultry Improvement Plan and Random Sample Testing than ever before. This is undoubtedly a sound basis for its work and considerable benefits, albeit long-term ones, are confidently anticipated.

An extensive investigational and extension programme related to the problem of egg quality is under way. The problem is a complex one as indicated in the Section's report and will almost certainly prove difficult of solution. It has special application in Queensland because of our climate.

The Poultry Section continues to be responsible for the Division's pullorum testing scheme. Details of the year's testing will be found in the Section's report. For information on diseases of poultry the reader is, however, referred to the Veterinary Services and the Pathology Branch reports.

Mention is made here that *The Poultry Industry Acts, 1946 to 1950* were amended during the year. The amending Act is numbered 8 Eliz. II. 20 and was assented to on 10th April, 1959. It is designed primarily to ease the problem of financing the work of the Poultry Section. This is financed from the Poultry Industry Fund, provision for which is made in the Acts.

STOCK MOVEMENTS

Interstate stock movements are set out in Table 1.

TABLE 1
INTERSTATE STOCK MOVEMENTS, 1958-59

	Cattle	Sheep	Pigs
Entered from Northern Territory	60,929	..	..
Entered from New South Wales	55,940	587,884	1,089
Removed to Northern Territory	3,487	..	..
Removed to New South Wales	357,035	194,460	72,089

CATTLE DISEASES

Tuberculosis

The compulsory tuberculin testing of dairy cattle was continued and extended. Two new supply areas at Biloela and Rockhampton were gazetted and testing recommenced in two vacant areas. There are now approximately 900,000 head of dairy cattle under regular test. Details of 12 months' tests are given in Table 2.

TABLE 2
DAIRY CATTLE TESTED FOR TUBERCULOSIS, 1958-59

Division	No. of Herds	Cattle Tested	No. of Reactors	Percentage of Reactors
Brisbane Division—				
Southport-South ..	152	11,854	31	0.26
Coomera-Southport ..	144	10,611	2	0.02
Beenleigh-North ..	76	2,899	22	0.76
North Brisbane-Petrie ..	64	3,081	10	0.32
Moggill-Kenmore ..	26	1,153	16	1.38
Samford ..	20	1,104	13	1.63
Beenleigh-Beaudesert ..	153	10,490	9	0.09
Beaudesert-Border ..	92	9,047	53	0.64
Dayboro ..	54	4,161	5	0.12
Dayboro-Mount Mee ..	12	886	1	0.11
Woodford ..	31	2,714	8	0.29
Caboolture ..	22	2,259	7	0.31
South Ipswich ..	230	10,507	5	0.05
Chambers Flat ..	12	631	..	..
Maroochy Shire ..	151	11,213	3	0.03
North Ipswich ..	206	8,634	4	0.05
Boonah ..	179	9,618	8	0.08
Maleny-Landsborough ..	160	9,384	27	0.29
Esk ..	92	6,845	17	0.25
Laidley-Lowood ..	19	486	1	0.21
Division Totals ..	1,900	116,837	252	0.22
Cairns Division ..	296	13,743	6	0.04
Townsville Division ..	20	1,892	4	0.21
Rockhampton Division ..	220	14,788	37	0.25
Maryborough Division ..	1,533	85,734	89	0.08
Toowoomba Division ..	1,644	84,019	37	0.04
Brisbane Division ..	1,900	116,837	252	0.22
Grand Totals ..	5,618	317,011	425	0.13

Departmental Veterinary Officers undertook the testing of milk-supply herds to such towns as Chinchilla, Miles, St. George, Emerald and Clermont, which are not covered by the compulsory testing areas as a public health measure.

Tuberculin testing of beef herds has been vigorously pursued in the Townsville district, where an average infection rate of 3.1 per cent. has been found in breeders on the suspect properties. One property showed an incidence of slightly more than 10 per cent., but it is gratifying to note that the incidence in beef herds under test has been greatly reduced. One isolated dairy herd, however, still shows a high percentage of reactors in spite of repeated testing. Short-interval testing will be adopted. Incidence of cases in North Queensland with no visible lesions appears to be high. Table 3 gives details of testing of cattle carried out by Departmental Veterinary Officers.

TABLE 3
T.B. TESTING BY GOVERNMENT VETERINARY OFFICERS, 1958-59

Division	No. of Herds	Cattle Tested	No. of Reactors	Percentage of Reactors
Toowoomba	35	3,133	4	per cent.
Townsville	13	6,661	209	3.1
Rockhampton	23	1,782	2	0.1
Maryborough	..	1,900	6	0.3
Brisbane	57	848	4	0.47
Cairns	..	237	27	11.4
Roma (practitioner) ..	8	2,578	27	1.05

Sterility Diseases

Brucellosis.—Considerable attention has been paid to strain 19 vaccination, but numbers vaccinated are still below the desired figure. Approximately 37,000 head were vaccinated, including a relatively small number of adult vaccinations. The practice of adult vaccination is now permitted in Queensland but is not recommended except in selected herds. The herd testing scheme is being continued in respect of porcine brucellosis. Presence of infection was shown in a small number of herds, in most of which a sterility problem existed.

Vibriosis.—This disease was detected in nine beef cattle herds. Most of these isolations were associated with an infertility problem. On one large commercial property 50 per cent. of cows tested were positive. Sulphadimidine therapy is being attempted on one property and an artificial insemination scheme has been adopted on another.

Further mucus agglutination tests have demonstrated the wide distribution of the disease in dairy herds. Antibiotic therapy is reasonably effective. The use of

artificial insemination in cattle on a section of the Atherton Tableland following the development of an artificial breeding centre there has markedly reduced the economic effects of *Vibrio fetus* infection.

Trichomoniasis.—Positive isolation of *Trichomonas foetus* was made in two beef herds. One bull was apparently the link between the two outbreaks. Acceptable methods of control are being considered. No further isolations have been made in dairy herds in spite of some hundreds of tests and no infected dairy herds are known to exist in the State.

Leptospirosis.—This disease has been associated with abortion storms on a lower plane than that observed several years ago. Calf infection has also been at a relatively low level. Whole-herd vaccinations against *Leptospira pomona* are increasing but the practice is by no means general even in enzootic areas.

Positive titres in cattle other than to *L. pomona* and *L. mitis* have been shown to occur.

Contagious Pleuropneumonia.—Three quarantines were imposed because of contagious pleuropneumonia outbreaks. One severe outbreak, mainly involving the calves in a mixed mob, was detected in slaughter cattle at a meatworks. No travelling mobs were quarantined except those entering the State for immediate quarantine on properties near the border.

The extension campaign was continued and 502 properties visited. On 173 of these, recommended control measures are being taken against the disease. Drought conditions over most of the endemic area curtailed normal stock work, with a consequent disregard of disease precautions. It is intended that greater emphasis will be laid on the supervision of inoculation of stock travelling from properties within the endemic area. Special attention will be paid to stores entering the Channel country. Good progress has been made with inoculation in areas where clinical cases of the disease are occasionally seen, but some opposition is met in those areas where the disease is rarely seen, but where carriers are present on the evidence of meatworks examinations.

It is proposed to set up two preliminary modified protected areas on a basis of blood testing, using the rapid slide agglutination technique and compulsory vaccination.

External Parasites

Cattle Tick.—After several years in which the number of infected properties in clean areas had been steadily reduced, a severe deterioration set in late in 1958 and worsened rapidly early in 1959. The areas most severely affected were the Toowoomba-Jandowae and South Burnett districts. The total of holdings quarantined rose from 26 to 97 in the Toowoomba Division and 50 infestations of previously clean holdings were reported in the South Burnett. Tick-infested cattle also reached saleyards at Jandowae, Quinalow and Toowoomba and slaughtering establishments at Warwick, Dalby and Toowoomba. Tick populations in infested and marginal areas have been high and resistance to some chlorinated hydrocarbon tickicides is severe.

Control of these outbreaks is proceeding satisfactorily, priority being given to holdings well removed from the infested areas. Several new dips have been charged with DDT and several spray dips installed.

The voluntary cleansing scheme in the Coalbank-Spring Creek area has successfully reduced tick infestations in the area but some new outbreaks occurred in clean country. Availability of staff and transport set some difficulties, but these appear to be on the way to solution.

No supervision charges are now levied for compulsory treatments and medicament is supplied free for mandatory herd treatments on infected properties in clean areas.

Observations are being continued on new dipping formulations, such as the organic phosphates, under field conditions on grazing properties in co-operation with the owners.

There is evidence of a falling susceptibility of ticks to DDT. In general, good control can be maintained by the normal dipping concentration of 0.5 per cent.

Observations have also been continued on pasture spelling as a means of tick control. Variable results have emphasised the importance of reliable fencing and stock control. Overwintering of ticks may also be a problem in central Queensland.

Observations on seasonal fluctuations in tick numbers in the Charters Towers area showed that two main peaks occurred. Grass larvae populations were apparently highest in September-October, followed by a marked depression in numbers until the end of the wet season, when a severe rise took place.

Buffalo Fly.—In spite of extremely favourable conditions the fly did not extend south along the coast as far as Bundaberg. It is thought that the increasing use of organic insecticides by graziers for tick control is tending to limit build-up. However, in inland areas the fly was heavy at Injune and penetrated as far as Roma and Charleville. Routine spraying of travelling cattle and the use of a mobile spray on the fringe of infested areas were continued.

Stickfast Flea.—This pest has now been detected in a number of western areas. Centres of infection have been located at Jandowae, Morven, Charleville and Wyandra. All exposed animals are treated with DDT.

Lice.—Cattle lice infestations were reduced and satisfactory control of sheep lice is reported. Action was taken to order the treatment of travelling flocks infested with sheep lice.

Internal Parasites

A survey of liver fluke infestation in cattle is being carried out in conjunction with officers of C.S.I.R.O. So far no major extension of the small known endemic area has been detected. However, one line of infected sheep was detected in north-western Queensland.

Some heavy infestations with *Haemonchus*, with considerable economic losses, were experienced in the south-west during the first three months of the year.

Lung worm of calves (*Dictyocaulis*) occurs in several areas. Treatment with a new specific appears to be satisfactory.

Tick Fever

Tick fever was unusually prevalent, partly owing to the extension of ticks into previously clean country and also due to heavy build-up of numbers of ticks in normally infested country. Almost all cases are ascribed to infection with *Babesia argentina*. Heavy losses occurred in marginal country, but properties recently infested also suffered losses, this being rather unusual.

Losses of up to 10 per cent. following vaccination were experienced in some mobs of starving stock moved from the clean country in the west to agistment in ticky areas.

Anaplasmosis

Isolated cases due to infection with *Anaplasma marginale* occurred, but no significant losses were reported. Oxytetracycline appeared to be effective therapeutically.

Winter Dysentery

The first cases of the so-called "winter dysentery" were noted on August 18, 1958, amongst show cattle at the Royal National Showground, Brisbane, where most of the beef cattle and some dairy cattle were affected with an acute dysentery of short duration. Cases on the Showground were generally mild and responded readily to intestinal sedatives.

The disease spread within a month to all the coastal dairying areas of the State and assumed a somewhat more intractable aspect. However, deaths were very few and usually due to complications. Only minor outbreaks occurred in beef cattle country and these were self-limiting. By early October the disease had ceased to involve new areas and rapidly declined. Recurrent attacks were noticed. Minor outbreaks recurred in the Toowoomba district in March and April.

There is little doubt that dispersal of cattle from the Brisbane Showground contributed to the rapid spread of the disease, but there is ample evidence that other means of spread occurred and that rigorous quarantine measures would have resulted only in individual hardship without having any worthwhile effect on the ultimate spread.

The main symptoms noted were excessive scouring and loss of production. Hyperthermia and blood in the scour were not constant features. The disease has definitely not been associated with cold weather.

Tetanic spasms associated with "winter dysentery" were reported in several fatal cases in the Rockhampton area.

MISCELLANEOUS DISEASES

Ephemeral fever appeared in the Nebo-Mackay area in December and spread throughout the Rockhampton and Townsville Divisions. Cases were generally mild and mainly restricted to young stock. Older animals appeared to retain some immunity from previous outbreaks. The outbreak was very similar to but generally more extensive than that reported in the North last year. A few losses were experienced in bulls under three years of age.

No reports of sawfly activity were received.

Neonatal mortalities were again quite widespread in the South Burnett but only scattered cases occurred in the Toowoomba and Brisbane areas. An outbreak was reported from Wandoan. The empirical use of vitamin K appears to give satisfactory results.

Investigations are continuing on coast disease. In spite of the failure to recover *Clostridium botulinum* toxin from the vast majority of field cases, toxoid inoculation appears to give very good field control. Outbreaks of St. George disease were noted near Roma and Mitchell in August and isolated cases continued until December. Following rain in January, outbreaks occurred suddenly between Roma and Surat. Losses were not heavy. Clinical symptoms were usually noted 14 days after the establishment of a green pick.

A feeding trial with 1.5 oz. of meatmeal or 5 g. of methionine was carried out, but losses were too light for the experiment to be conclusive. However, the higher levels of meatmeal feeding appeared to have some slight beneficial effect.

Klebsiella spp. were again incriminated in mastitis cases and were associated with fatal septicaemia in a calf.

DISEASES OF SHEEP

Several outbreaks of ovine abortion were noted. On one property, losses reached 40 per cent. *Brucella ovis* was isolated from an aborted foetus and from rams on the same property. It appears that this organism may be responsible for infection and abortions in ewes of British breeds in Queensland as well as sterility in rams. There is no evidence to suggest that the organism is important as a cause of abortion in Merino ewes in this State.

No confirmed outbreaks of footrot occurred, although the occurrence of the disease has been suspected on clinical grounds.

Tetanus, enterotoxaemia and infectious labial dermatitis were commonly observed.

An extensive survey of the incidence of *Coxiella burnetti* in sheep, cattle and kangaroos has been undertaken in conjunction with the Department of Health and Home Affairs. In some 200 cattle sera from 12 centres in western and south-western Queensland, only one serological positive was detected. The south-eastern samples were taken from properties suspected as the origin of human Q-fever cases. A large number of sheep sera were obtained from slaughtering establishments and *Amblyomma triguttata* from sheep and kangaroos. A muscular dystrophy of sheep was reported from Goondiwindi. This condition has been confined to one property for several years and appears to be becoming more prevalent. Observations are being continued.

DISEASES OF HORSES

A fatal debilitating disease of horses was recognised on two properties in Central Queensland characterised by progressive emaciation, ataxia and death. Over a period of four years some 25 per cent. of the horses on one property had died. An acute form in which horses rapidly succumbed in convulsions was also described.

Three positive blood transmission tests were obtained from the original suspect properties and one from an individual case on a property some hundred miles to the south. The reaction in susceptible horses following the inoculation of virulent blood or filtered plasma was characterised by intermittent temperature rises and a variable degree of weakness, emaciation and anaemia. Serial transmission was effected without difficulty from the positive cases.

A further positive case has now been detected on the basis of pathology and positive transmission in the Roma area, and there is a grave suspicion of the occurrence of the disease in a horse in Brisbane.

There is some field evidence that the disease is more widespread in the Rockhampton hinterland than is indicated by the positive transmission tests, but in spite of extensive tests no confirmation of this has been obtained. It is probable, however, that the disease has been present in the area for a considerable time but that losses have been previously ascribed to such entities as worm infestation, Birdsville disease and dental trouble.

Acute and chronic forms are recognised, deaths occurring in a few hours to 12 months after the first exhibition of symptoms. The typical autopsy findings are enlargement of the liver and spleen, usually associated with anaemia. Depositions of haemosiderin in the lung and spleen are constant features. The heart muscle is usually flaccid and friable. Blood sedimentation time is markedly reduced and this test is being used extensively in field investigations although its limitations are recognised.

In view of the fact that no definite diagnosis has been possible in spite of extensive field and laboratory studies, the disease has been designated as virus disease of horses, but it undoubtedly presents many features consistent with equine infectious anaemia. Further work to obtain a definite diagnosis is in progress.

Field and serological investigations have indicated that a rhinopneumonitis of horses has occurred in the area but is probably not associated directly with the disease under investigation.

All known infected properties are under strict quarantine in regard to horses and all surrounding properties declared a buffer area from which movement of horses can only be effected after inspection. Special arrangements have been made for the removal of cattle from infected properties. In addition, certain restrictions have been imposed with respect to interstate movement of horses.

An extensive survey has been made of suspect cases in other parts of the State but only one further case (at Roma) detected. Shortage of suitable horses and insectary space is a limiting factor in such investigations. Investigations into the incidence of virus disease of horses has revealed the presence of an extensive outbreak of a catarrhal rhinitis in horses in Central Queensland.

Tetanus was frequently diagnosed and an enzootic area detected in the Central-west. Organised toxoid inoculations are being undertaken in this area.

Strangles vaccination of working horses is extensively practised.

Only one outbreak of Birdsville disease on one property in north-western Queensland was reported. Drought conditions over much of the enzootic area were primarily responsible for the low incidence.

Walkabout occurred near Charters Towers.

Melioidosis associated with abscess formation in the pons and medulla was confirmed in a horse.

DISEASES OF PIGS

Melioidosis and sparganosis were again confirmed in northern pigs. The incidence of erysipelas was low but paralysis of young pigs is being noticed more frequently.

Pneumonia was common and in many cases *Pasteurella* spp. were isolated from organs.

There is evidence that some stud piggeries are infected with virus pneumonia.

DISEASES OF POULTRY

Respiratory diseases, mainly chronic respiratory disease (C.R.D.), were prevalent. Fowl cholera was recorded in North Queensland.

More than 60,000 fowls were inoculated against infectious laryngotracheitis.

A severe outbreak of pullorum disease occurred in chickens from one hatchery which has been under blood tests for a number of years. Pullorum infection had been progressively reduced from 5 per cent. to 0.2 per cent. in 12 years. It was shown that the incubator hygiene was faulty and steps have been taken to improve this.

Streptococcal septicaemia was recorded in young chickens, frequently associated with stress factors such as long transport, debeaking and chilling.

POISONING

Arsenical poisoning was again prevalent. Of seven outbreaks in the Brisbane area, three were traced to dipping, one to contaminated soil, one to discarded arsenical tins, one to contaminated mineral mixture and one to baits, while the source of one fatality was unknown.

In the case of the mineral mixture, a tin of dip concentrate had leaked onto the bag of mineral mixture, which was then fed. Although only three cows died, another 17 were severely affected.

Twenty-one weaners died after licking the rails of a draining pen and surrounding soil. Arsenic had not been used in this dip for the previous seven years.

Isolated cases of lead poisoning occurred, mainly in calves.

Loss of sheep following drenching with organic phosphates against stomach worm was reported. In at least one case copper vessels had been used.

Benzene hexachloride and overstrength organic phosphates caused losses when used for tick control. Severe scalding followed the use of one proprietary brand of organic phosphate. The predisposing cause in this case is unknown.

Endrin was responsible for deaths in cattle and in fowls. BHC caused deaths in pigs.

Drought-breaking rains were in many cases followed by severe losses due to ingestion of Noogoora burr. Pigs were involved in many of these outbreaks.

Heavy losses in travelling cattle occurred in the Quilpie area, where portions of the stock route are heavily covered with Ellangowan poison bush (*Myoporum deserti*).

Rock fern (*Cheilanthes sieberi*) caused deaths at Killarney under stress conditions. Cattle were put on the road in hot weather after ingestion of quantities of the plant. Ergot poisoning was recorded but was generally light.

Ingestion of plants high in oxalate, such as *Portulaca oleracea* and *Tetragonia tetragonoides*, was responsible for deaths at Condamine and Roma.

Solanum esuriale was identified in the rumen of sheep suffering from humpy-back.

Deaths occurred in cattle awaiting slaughter from ingestion of red-headed cotton-bush (*Asclepias curassavica*).

Losses from hydrocyanic acid were very light. Ice-land poppy (*Papaver nudicaule*) was again incriminated, this time in losses of sheep.

Xanthorrhoea sp. aff. *media* (grasstree) was incriminated as a toxic agent at Jandowae and Oakey. Losses due to grasstree are usually restricted to the coastal areas.

As usual, sporadic deaths were credited to ingestion of poisonous plants. The following plants were incriminated quite commonly:—Heart-leaf poison bush (*Gastrolobium grandiflorum*), Cooktown ironwood (*Erythrophloeum chlorostachys*), Darling pea (*Swainsona luteola*), bitterbark (*Alstonia constricta*), Brazilian nightshade (*Solanum seaforthianum*), corkwood (*Duboisia myoporoides*), cestrum (*Cestrum parqui*), lantana (*Lantana camara*), bracken (*Pteridium aquilinum*), poison peach (*Trema aspera*), yellow-wood (*Terminalia oblongata*), and thornapple (*Datura* spp.).

BRANDS

Details of registrations, transfers, etc. for the year 1958-1959 are as follows:—

Item	No.	Number since Inception of Legislation
Ordinary three-piece horse and cattle brands registered	1	92,242
Cancelled horse and cattle brands re-allotted	786	20,029
Horse and cattle symbol brands registered	178	3,495
Horse and cattle brands transferred	1,464	90,480
Cattle earmarks registered	591	39,509
Sheep brands and earmarks registered	243	15,947
Sheep brands and earmarks transferred	195	10,841
Distinctive brands registered	3	1,359
Alterations of address	244	..
Brands cancelled	18	..
Earmarks cancelled	141	..

There was an increase in the number of registrations and transfers of horse and cattle brands, symbol brands and cattle earmarks, and a decrease in the registrations and transfers of sheep brands and earmarks.

The total fees received were above the average for the last 10 years.

Very few cases of irregular branding and earmarking were reported and owners generally appear to be observing the requirements of the Acts. Two owners were proceeded against successfully for irregular earmarking.

Revised copies of the Horse and Cattle Brands Directory and the Sheep Brands and Earmarks Directory were placed in the hands of the Government Printer.

EXTENSION

Field days and film evenings were held in all Divisions. Several new films of general interest were acquired for showing and films of special interest shown to selected groups. There was successful co-operation in field days with commercial interests.

Three Veterinary Officers and eight Stock Inspectors attended schools of extension methods.

The extension campaign against pleuropneumonia was continued.

Apart from special newspaper articles and broadcasts, a regular land page is now published in one provincial newspaper from material supplied by Branch officers.

QUARANTINE

Surveillance of cattle imported prior to the ban on imports was continued. No evidence of warble infestation was detected.

The shipment of cattle overseas fell sharply from the record figures achieved in the previous year. The greatest reduction was in exports to the Philippines, only 289 breeders and 870 slaughter cattle being exported as against 1,787 breeders and 15,203 slaughter cattle in 1957-58. The reasons for this decline were, firstly, revised import regulations in regard to Queensland cattle, and secondly, the development of the

slaughter trade from the closer ports of Darwin and Derby. Although Queensland slaughter cattle are still in high favour with Manila buyers, the additional 5-6 days' transport is a severe handicap. Total imports of slaughter cattle to Manila have been restricted by import licencing requirements.

A total of 685 cattle was shipped to New Guinea, mainly on M.V. "Natone". Several shipments were for slaughter but complied with the requirements for breeding cattle.

Seventeen horses were exported to New Guinea, but a very promising market in Thailand had to be abandoned in view of the occurrence of virus disease of horses in Central Queensland.

Air transport was used to convey 58,310 day-old chicks to New Guinea, mainly from the Toowoomba and Brisbane areas.

Final certification was given for three Poll Hereford heifers *ex* New South Wales consigned to Great Britain and for 10 horses to Tahiti.

Blood containing *Anaplasma centrale* was forwarded to Manila for the immunisation of breeder cattle imported from New Zealand.

One hundred and seven reptiles were exported to zoos and institutions in the United States. Eighteen reptiles were exported to Scotland.

SLAUGHTERING

The construction of District Abattoirs has already been referred to.

Grading as required by The Meat Grading Regulations of 1955 has been suspended until June 30, 1960, but a voluntary grading system whereby, at the request of the butcher, prime quality meats will be marked accordingly, and the ribbon branding of all lamb carcasses, are being introduced.

Prewrapped meat is firmly established in Brisbane and Toowoomba and is now appearing in the provincial cities. In general the sales are associated with supermarkets; in some cases a licence is held by the owner of the market, in others the space may be leased by a butcher. The operation of the shops is generally satisfactory and the standard of hygiene is high.

The setting up of District Abattoirs has improved the inspection of meat in country centres.

BREACHES OF ACTS

There was a slight rise in the number of prosecutions for breaches of the Stock Acts. Successful legal action was taken against 19 persons. The extension of tick infestations necessitated legal action in some cases where previously a warning may have been considered sufficient.

Infringements of the Slaughtering Act are always regarded seriously and it is gratifying to record that only nine actions were necessary under this Act.

NEW LEGISLATION

Amendments were made to the Stock Acts to provide for the institution of a voluntary milage payment scheme in regard to veterinary practitioners and to provide certain machinery clauses found necessary.

A new Act, "The Foot and Mouth Disease Expenses and Compensation Fund Act of 1958," to provide finance, in conformity with other States, in the event of an outbreak of this disease received Royal Assent.

"The Abattoirs Acts, 1930 to 1958" were amended to permit slaughtering for consumption outside the Brisbane Abattoir area and to provide for registration of District Abattoirs.

TABLE 4
STOCK SLAUGHTERED FOR LOCAL CONSUMPTION, 1958-59

	Bullocks	Cows	Calves	Sheep	Swine
Bacon Factories	18,703	75,987	55,345	26,523	295,079
City of Brisbane (Abattoir)	95,760	74,475	95,819	730,197	39,803
Larger Population Centres	153,990	143,215	142,109	407,919	97,670
Country Centres	31,507	33,082	16,246	76,130	15,679
Totals	299,960	326,759	309,519	1,240,769	448,231

PATHOLOGY BRANCH

Activities of the Pathology Branch continued the trend of earlier years in that the work of each section increased during 1958-59.

DIAGNOSIS OF ANIMAL DISEASE

It is evident from diagnoses made during 1958-59 that an experienced fully staffed diagnostic section is the most essential part of the laboratory. As knowledge of the diseases present in Queensland increases, the variety of tests performed and the need for specialists in individual fields of animal pathology become greater. In addition, the investigation in the laboratories of each new disease recognised entails considerable diversion of staff and equipment until its importance can be assessed and methods of diagnosis accurately determined.

An increasing number of specimens for diagnostic purposes was received from Government Experiment Stations and farms. It is important to know that animals included in experiments are healthy.

The number of batches of specimens examined each month during 1958-59 was as follows:—

July 476	January 351
August 456	February 464
September .. 444	March 469
October 495	April 417
November .. 409	May 394
December .. 390	June 402

Fluctuation in the numbers and types of specimens received monthly often makes difficult the performance of research projects as planned.

Cattle

Diagnosis of numerous cases of poisoning, many avoidable, were again recorded for 1958-59.

Plants to which losses of cattle were attributed included kurrajong (*Brachychiton populneum*) and grass-tree (*Xanthorrhoea* sp. aff. *media*).

Arsenic poisoning was encountered on 17 occasions and lead poisoning on eight. Two instances of poisoning with petroleum products were recorded.

Diagnoses made on specimens from cattle included:

Actinobacillosis.—The necessity for careful differential diagnosis of diseases was shown in a case of actinobacillosis occurring near Ayr. This animal was sick for three weeks with symptoms which could be confused with bovine malignant catarrh, a disease not known to occur in Queensland. Bacteriological and histological examination confirmed the diagnosis of actinobacillosis.

Infectious Diarrhoea.—This was diagnosed in bulls received at Yeerongpilly for immunisation against tick fever. No evidence of transmission to in-contact cattle was noted. Specimens, with reports suggesting this disease, were received from a number of properties. No transmission tests were done.

Tick Fever.—One hundred and nine outbreaks were diagnosed by examination of field smears. Seven were considered to be mixed infections due to *Babesia argentina* and *B. bigemina*, 91 to *B. argentina*, 4 to *B. bigemina*, and 7 to *Anaplasma marginale*.

Mastitis.—With the advent of efficacious antibiotics, bovine mastitis caused by *Streptococcus agalactiae* is not diagnosed as frequently as in years before the discovery of these antibiotics. A disturbing feature in recent years has been the presence of other types

of bacteria in clinical cases of mastitis. The results of examination of milk samples submitted to Yeerongpilly during 1958-59 were as follows:—

<i>Staph. aureus</i>	388
<i>Str. agalactiae</i>	91
<i>Str. dysgalactiae</i>	4
<i>Str. uberis</i>	28
<i>Str. group G</i>	2
<i>Corynebacterium pyogenes</i> ..	14
<i>Pseudomonas</i> sp.	13
<i>Klebsiella</i> spp.	25
<i>Escherichia coli</i>	7

The bacteriological examination of milk samples is often time-consuming as no bacterium isolated can be considered as a contaminant and must be identified as fully as possible. The figures show the importance of *Staph. aureus*.

Two cases of mastitis caused by *Klebsiella pneumoniae* occurred in cows at Yeerongpilly. In spite of intensive antibiotic therapy one animal died. Although the organism was isolated frequently from milk samples from this cow, *K. pneumoniae* was not isolated on post-mortem. The isolation of these organisms from field cases of mastitis increased during 1958-59 compared with previous years.

Since the C.S.I.R.O. ceased research on mastitis, there is no active work being done on this problem, yet the loss of production caused by this disease is still very great.

Contagious Pleuropneumonia.—An outbreak of acute bovine pleuropneumonia in calves in Maryborough was confirmed by serological testing and isolation of *Mycoplasma mycoides*.

Coast Disease.—Instances of locomotory disturbances and paralysis among cattle along the coastal areas of Queensland are not uncommon. Information on the causes is gradually accumulating as more specimens from affected animals are received, but the relative importance of each cause cannot be assessed. Botulism is thought to be one factor but in only three out of 16 specimens submitted in the period 1954-1959 has demonstration of *Cl. botulinum* type D toxin been possible.

Plant poisoning (*Xanthorrhoea* sp. and *Macrozamia* sp.), starvation or mineral imbalance, bacterial infection (salmonellosis and melioidosis), ephemeral fever and cerebral tumours have all been encountered.

Mycotic Abortion.—*Candida tropicalis* was isolated from the placenta of a 3-months-old foetus. As no bacterial pathogens were isolated, it is possible that this was an instance of mycotic abortion similar to those reported by British workers.

Miscellaneous Diagnoses.—Infectious diseases diagnosed in specimens from cattle included salmonellosis, brucellosis, mycotic dermatitis, vibriosis, trichomoniasis and two outbreaks of pasteurellosis.

Histological diagnoses included a mixed suppurative and granulomatous pneumonia in a calf and an epithelialising pneumonia in a Jersey cow.

Sheep

Plants suspected of causing poisoning in sheep during 1958-59 included *Eremophila maculata* (native fuchsia), *Crotalaria dissitiflora*, *Solanum esuriale*, *Amaranthus macrocarpus* and *Terminalia oblongata* (yellow-wood).

Infectious diseases diagnosed in sheep included brucellosis, blackleg, pasteurellosis, salmonellosis and mycotic dermatitis.

Parasitological examination of skin scrapings showed itch mite in 20 specimens and lice in 11.

Amongst the many pathological conditions seen, of special interest was a myopathic syndrome. For several years a property in south-western Queensland has reported sheep with lameness and abnormal gait. A number of affected sheep submitted for examination were examined at Yeerongpilly. Only slight changes visible to the naked eye were seen, but histological examination showed more or less extensive degeneration of muscle tissues in all sheep killed.

Acute selenosis caused deaths of sheep in Central Queensland.

Brucellosis.—For the first time in Queensland, brucellosis was diagnosed in ewes and foetal material. Two outbreaks occurred, one in Dorset Horn ewes and the other in Romney Marsh ewes. In the first outbreak *Br. ovis* was isolated from vaginal discharge from a ewe and lung tissue of aborted lambs and in the second, lung tissue from a foetus yielded *Br. ovis*. Cotyledonary material from the first outbreak injected intravenously into Merino ewes in late pregnancy did not induce abortion but *Br. ovis* was present in the cotyledons of membranes obtained at lambing as judged by smear examination and was recovered by culture methods.

Pigs

Infectious diseases diagnosed included erysipelas, pasteurellosis and salmonellosis.

The following diagnoses were of interest.

Acute polyarthritis caused death of four 5-months-old pigs and four others were affected. The cause was not established.

A number of reports were received from abattoirs of pigs showing arthritis. Bacteriological examination of several of the affected joints failed to reveal any pathogens.

Sub-acute leptomeningitis and encephalomalacia was diagnosed histologically in nine pigs three weeks of age from one property, and histological examination showed lesions of a non-purulent encephalomyelitis and leptomeningitis in two piglets from another property. Lesions typical of those described for exudative epidermitis were seen in one pig. Streptococcal endocarditis and septicaemia occurred in pigs from three properties in North Queensland.

Horses

Diagnoses included a viral disease not previously recognised. Because of the resemblance of this disease to equine infectious anaemia, it has been actively investigated. This work is recorded under the research section of this Report.

Pseudomonas (Malleomyces) pseudomallei was isolated from the brain of a horse in North Queensland. Post-mortem examination showed no abnormality but microscopic examination revealed numerous small abscesses in part of the brain tissue.

An interesting case of a rare disease called amyloidosis, which causes renal failure, was diagnosed histologically in a gelding 15 years of age. The horse had shown progressive emaciation and was therefore destroyed.

Goats

Enterotoxaemia was diagnosed in one case. Milk samples, blood-tinged in appearance, were submitted on a number of occasions but no recognised pathogens were isolated. *Mycoplasma* sp. was isolated from lung tissue and peritoneal exudate on one occasion.

Birds

Specimens from fowls and cage birds constituted a large percentage of all specimens submitted for examination.

Salmonella pullorum was diagnosed both at Oonoonba and at Yeerongpilly in chickens originating from one hatchery. This disease is now relatively rare, no doubt as a result of the blood-testing scheme carried out by the Department, but the existence of isolated infections

suggests that the control programme should not be relaxed and that prompt action is necessary when the disease is diagnosed.

There was a noticeable increase in the number of cage birds submitted for examination. Diagnosis of diseases in budgerigars and other small birds is difficult, and satisfactory diagnoses in these birds are often not possible. Psittacosis was diagnosed and warrants mention, as the disease is transmissible to man.

Infectious laryngotracheitis virus was isolated from seven batches of specimens submitted to Yeerongpilly. At Oonoonba the virus was isolated from a fowl vaccinated three months previously by the simultaneous fowl pox-I.L.T. feather follicle method. An outbreak had occurred in the flock from which the bird originated.

Other Specimens

Parasitology.—The parasitology section received a wide range of parasites for identification.

Bacteriology.—One unusual specimen examined bacteriologically was a specimen of meat which luminised in the dark. This was shown to be caused by contamination with *Photobacterium*.

Serology.—The serology section again handled a large number of blood samples (Table 1). The complement fixation test for contagious pleuropneumonia was modified as a result of information obtained in Melbourne.

TABLE 1
SEROLOGICAL TESTS

Disease	Yeerongpilly	Oonoonba	Total
Complement Fixation Tests—			
Contagious pleuropneumonia—cattle ..	1,425	945	2,370
Johne's Disease—cattle ..	3	..	3
Psittacosis — lympho-granuloma group ..	34	..	34
Q Fever—sheep ..	8	..	8
Brucellosis—sheep ..	138	..	138
Melioidosis—sheep ..	..	1,280	1,280
pigs ..	..	31	31
Serum Agglutination Tests—			
Brucellosis—cattle ..	4,188	1,107	5,295
pigs ..	1,890	102	1,992
horses ..	8	..	8
goats ..	2	..	2
Leptospirosis—cattle ..	3,034	650	3,684
pigs ..	975	184	1,159
horses ..	6	..	6
goats ..	2	..	2
sheep ..	12	..	12
Erysipelas—pigs ..	75	..	75
sheep ..	13	..	13
Mucus Agglutination Tests—			
Vibriosis—cattle ..	3,022	682	3,704
Haemagglutination Tests—			
Melioidosis—cattle ..	..	92	92
horses ..	..	3	3

RESEARCH

Research during 1958-59 centred on the viral disease of horses, studies of the tick fevers, and insecticide studies on external parasites of sheep and cattle.

Viral Disease of Horses

In March 1958, blood was received from a horse with a chronic disease characterised by anaemia, emaciation and anasarca. Laboratory tests have established that the disease can be transmitted to horses after filtration through collodion filters with pore diameter of 160 millimicrons.

Clinical symptoms, histological appearance of tissues from natural and experimental cases and the characteristics of the infective agent together indicated that the disease was closely allied to equine infectious anaemia, a disease not known to be present in Australia.

Immediately the nature of the disease was known, investigation into its occurrence was actively pursued. Studies on the distribution of the disease were commenced and are still in progress. The original case was diagnosed in Central Queensland. The virus does not transmit to animals other than horses; hence this investigation involved the purchase, housing and observation of horses.

There is no certain test for the diagnosis of equine infectious anaemia other than transmission to horses. Serological work has shown that serums of experimentally infected horses have increased ability to agglutinate chick erythrocytes and the possibility of using this as an aid to diagnosis was investigated. However, it was found that the response lasted only a short time and it is unsuitable as a diagnostic procedure. Also, some animals showed low titres prior to infection.

In an attempt to obtain further proof of the identity of the disease, sera were sent to an Italian laboratory where complement fixation tests are used for diagnosis of equine infectious anaemia. The results did not help in identifying the disease occurring in Queensland.

Tick Fever Research

Persistence of Babesia argentina in Cattle Inoculated with Infected Blood.—In contrast to the results reported last year, when the animals were infected for only three months, blood from a steer inoculated with *B. argentina* in April 1958 was still infective for recipient animals up to the end of April 1959.

Effect of Regular Doses of Infective Blood on Immunity to B. argentina.—These experiments, conducted over two years, have now been completed. Inoculation monthly with infected blood was shown to prolong considerably the usefulness of a bleeder as a donor animal. However, use of blood from such an animal does not always result in infection and therefore the procedure cannot be recommended.

During these experiments, it was noted that the 5 ml. dose of blood recommended in field use, inoculated subcutaneously, did not always infect or immunise. On the other hand, 100 ml. doses regularly produced infection and immunity. This observation may be of significance in explaining lack of immunity occasionally reported after the inoculation of tick fever vaccine supplied by the laboratories.

Maternal Transmission of Immunity.—It has always been of interest to know how calves born in tick-infested areas become immune. Studies done at Oonoonba showed that calves from cows immunised with infective blood have marked resistance for some weeks after birth if challenged by injection of *B. argentina* infected blood. Although the calf becomes infected, there is no evidence of disease.

Cross Immunity Experiments Using Laboratory and Field Strains of Tick Fever Organisms.—Bleeders immune to the laboratory strain of *B. argentina* were challenged by infesting them with ticks carrying a field strain of *B. argentina*. Results obtained by challenging nine animals in this way indicate that the immunised animal showed no ill-effects following infestation with *B. argentina* infected ticks up to two months after the primary reaction.

B. bigemina.—Cattle immunised with the vaccine strains of *B. bigemina* and *B. argentina* were challenged with blood containing a field strain of *B. bigemina*. The results indicated that there was a high degree of protection conferred by the immunisation procedure against the challenging strain, although the number of parasites present in the blood was greater in those animals challenged with the field strain as compared with those challenged with the homologous vaccine strain of *B. bigemina*.

Susceptibility of Individual Animals to Infection with Babesia spp.—A marked variation exists in the response of individuals or of groups of cattle to infection with species of *Babesia*. Work is in progress to determine the mechanism underlying the resistance or susceptibility of an animal to infection with *Babesia*. Several methods of estimating the response of cattle to infection have been tried. The most satisfactory one has been a system of estimating the number of parasites in blood based on that used in research on *Plasmodium cathemerium*.

Tick Transmission Studies.—During the year, success was achieved in infecting ticks free from *Babesia* with strains of both *B. bigemina* and *B. argentina* under laboratory conditions. This appears to be the first time this has been done. It is hoped that these ticks known to be infected with only one species of *Babesia* will be very useful in research on tick fever, for work done at the Animal Research Institute and the University of Queensland Veterinary School has indicated striking differences between infections brought about by inoculation of infected blood and those transmitted in infected ticks. For instance, in young susceptible calves, especially when splenectomised, a tick-induced babesiosis seemed less severe than the blood-induced disease. These calves, even though splenectomised, recovered from *B. argentina* infection resulting from infestation with infected ticks.

Natural History Studies.—Repeated attempts to induce *B. argentina* infection by infesting cattle with the larvae of ticks collected from animals following or during outbreaks of tick fever were unsuccessful. It is probable therefore that not all ticks are infected. However, one batch of ticks collected from a herd in the Beaudesert area about one month after the first case of tick fever occurred transmitted *B. argentina* to a beast held at the laboratory. The progeny of the ticks transmitted the disease to two animals, but ticks of the next generation did not prove infective.

Attempts to infect laboratory-bred ticks with the vaccine strain of *B. argentina* have all been unsuccessful. No transmission occurred in over 20 attempts using the progeny of ticks that were in various stages of development during the reaction period of the host animal. These experiments indicate that spread of tick fever by blood vaccine is unlikely.

It proved possible to infect laboratory-strain ticks by allowing them to mature on an animal inoculated with blood containing the Beaudesert strain of *B. argentina*. Ticks became infected when they were present as adults during the febrile stage of the disease, but ticks present as larvae or young nymphs failed to acquire infection except in one case when transmission was obtained from the progeny of ticks present as larvae at the time of reaction of the host. However, it is possible that the host animal had a relapse when the ticks had developed to the adult stage.

Larval ticks were able to transmit infection. Repeated spraying with insecticide starting four days after infestation by larvae from known infected ticks failed to prevent *B. argentina* infection.

Although larval ticks placed on an animal 2-3 days after the start of emergence from eggs transmitted *B. argentina* to cattle, attempts to transmit *B. argentina* by injection of finely ground infective larval ticks were unsuccessful.

The effect of temperature on the survival of *B. argentina* in the various non-parasitic stages of the tick is under investigation. Tick eggs that have completed from one-half to one-third development and then held at about 5 deg. C. for 14 days completed their development when returned to 30 deg. C. and the hatching larvae transmitted *B. argentina*.

Investigations on tick transmission of *B. bigemina* are in progress with the co-operation of a protozoologist working at the Queensland University Veterinary School.

Therapy of Tick Fever.—Treatment with a drug commonly used in the treatment of tick fever in Queensland did not prevent uninfected ticks becoming infected with *B. argentina*, Beaudesert strain. Ticks collected from a calf treated with the same drug for *B. bigemina* infection failed to transmit this parasite in the next generation.

Clinical Tick Fever.—Observations made during the year indicated that spraying and killing ticks early in the reaction following inoculation of *Babesia* may increase the severity of the reaction. Further investigations of this phenomenon are in progress.

Parasites of Sheep

Insecticide Trials.—An attempt was made to increase the persistence of organic phosphorus insecticides on sheep carrying short wool under summer conditions by incorporating DDT in the spray. Sheep were jetted along the back as for body strike control, with diazinon

0.04 per cent. and Delnav 0.1 per cent. with and without the addition of 0.25 per cent. DDT. Wool samples were examined biologically in the laboratory for the presence of insecticides. The addition of DDT did not increase the persistence of either insecticide. Effective concentrations of diazinon were present in the base of the fleece for seven weeks with the addition of DDT and for eight weeks without DDT. Delnav persisted for eight weeks and Delnav plus DDT was effective for seven weeks.

DDT (0.25 per cent.) applied on its own had moved away from the base of the fleece after about three weeks but persisted in the remainder of the staple for the 14 weeks the sheep were under observation. The tip of the fleece from sheep jetted with the mixture containing DDT showed a similar result.

A comparison of the results from the basal $\frac{1}{4}$ in. of the staple and the remainder of the staple showed that diazinon was completely absent from the bulk of the staple after eight weeks. Sufficient may remain at the base of the staple to give partial protection against developing larvae for a further two to three weeks. With Delnav the reverse applied. The base became virtually free after eight weeks but the remainder of the staple contained sufficient insecticide to prevent larval survival in about 50 per cent. of the samples for the 14 weeks the sheep were observed. Delnav appeared to persist but moved outwards with wool growth or by washing with yolk secretions. The loss of DDT from the base of the staple was too rapid to be accounted for by wool growth.

The organic phosphorus insecticide O,O-dimethyl, 0-2,4,5-trichlorophenyl phosphorothioate (Korlan, Dow Chemical Co.) showed useful properties as an insecticide against *Lucilia cuprina*. It has been tested at a jetting concentration of 0.25 per cent. active ingredient and has persisted for at least 18 weeks at the base of the fleece. Further work at lower concentration is required before finally assessing its value.

The organic phosphorus insecticide O,O-dimethyl S(N-methyl carbomoyl methyl) phosphorothiolothionate (Rogor, Fisons Pest Control Ltd.) at a jetting concentration of 0.25 per cent. active constituent had completely lost its efficacy when checked three weeks after treatment.

Resistance of *Lucilia cuprina* to Insecticides.—Blowflies collected from sheep following failure of either aldrin or dieldrin to control strike in the field have been checked in the laboratory for resistance to several insecticides.

Resistance was determined by growing freshly hatched larvae in a liquid media containing varying amounts of insecticide and comparing the mortality 24 hours later with that of a non-resistant laboratory strain exposed to the same concentration of insecticides.

Blowflies collected from Cunnamulla, Blackall and Tambo districts proved to be at least 50 times as resistant to dieldrin as the laboratory strain. These flies were also resistant to endrin and to benzene hexachloride. None of the strains showed resistance to DDT or diazinon.

The Tambo-strain larvae were checked by the implant technique on sheep jetted along the back with 0.25 per cent. dieldrin. One week after treatment Tambo-strain larvae were alive in all of 10 sheep whereas there were no survivors from the implants of non-resistant laboratory larvae. A biological test in the laboratory confirmed the result.

Itch Mite (*Psorergates ovis*).—Frequent examination of skin scrapings from three sheep with itch mite infestation confirmed a previous observation that the mite population decreases with the onset of summer and does not start to increase again till the late autumn. This decrease of population occurred even if the sheep were in roofed pens.

Patch tests with 1.1 bis(chlorophenyl)2,2,2-trichloroethanol (Kelthane) showed that a concentration of 0.05 per cent. did not kill all mites present but at 0.1 per cent. the kill was more successful.

One animal showing a moderate mite population and marked symptoms up to December 1957 has shown a spontaneous cure. The mite population declined rapidly after shearing in December 1957, and no mites could be detected during the cooler months of 1958 or to date this year even though this animal is continuously penned with infested animals.

Body Lice (*Damalinia ovis*).—It is frequently claimed that jetting of sheep in strips along the back and sides will reduce body lice infestation to very low levels. Controlled experiments showed that jetting along the back with the organic phosphorus insecticides Asuntol, Delnav and diazinon will not control lice infestation. The actual areas treated are free of lice but there is a rapid increase in lice population in the non-treated areas and the sheep develop the typical appearance of lice infestation.

Biochemical Study of Enterobacteriaceae

One hundred and forty-one strains of bacteria belonging to the family Enterobacteriaceae were tested for biochemical characteristics.

Bacteria of this family are extremely common in specimens submitted for bacteriological examination and some species can cause disease. The results showed that more detailed study of these bacteria is desirable but routine identification of some of the rarer species would not be warranted at this stage. However, some of the tests used in this study are now applied in routine testing.

Ovine Infertility Diseases

In November 1958 a Border Leicester ram was submitted with a history of epididymitis. Bacteriological examination of semen showed the presence of a gram-negative bacillus which has been tentatively placed in the genus *Actinobacillus*. Two Merino rams inoculated with semen from the natural case developed epididymitis and the bacterium could be isolated from semen samples from these rams. One of the two rams inoculated with a culture of the organism isolated from the natural case also developed epididymitis and the organism was re-isolated from semen samples. Further investigations are planned to assess the importance of this organism as a cause of disease in sheep.

Serological studies on the complement fixation test for ovine brucellosis resulted in the preparation of an antigen by rupture of the bacterial cells with a Mickle disintegrator followed by high-speed centrifugation. The result was a soluble antigen highly active and free from anti-complementary activity.

Sera collected during the ovine brucellosis flock mating experiment are now being examined. Preliminary work has shown that a satisfactory complement fixation test can also be done for the *Actinobacillus*-like organism mentioned above.

Melioidosis

In northern Queensland *Pseudomonas pseudomallei* has now been isolated from sheep, goats, pigs, cattle and horses. The disease in all animal species is manifested by abscesses in various sites in the body, including viscera, joints and brain.

Current work entails the development of serological methods of diagnosis with concentration on the complement fixation test in sheep. This test will detect infection in sheep but some difficulty is experienced with non-specific fixation, although all infected sheep have shown titres higher than the maximum non-specific result. A limited amount of work shows that this test will detect infection in pigs.

An haemagglutination test is proving more satisfactory for testing cattle sera than the complement fixation test.

Monthly testing of the sheep at Oonoonba with slaughter of the positive reactors indicates some source of infection other than carrier animals. In south-east Asia *Ps. pseudomallei* has been isolated from the mud in paddy fields. Attempts to recover the organism from mud in swamps in the paddock containing the sheep have been unsuccessful.

TICK FEVER IMMUNISATION

Facilities for immunisation of cattle against tick fever were actively sought by livestock owners. Two hundred and seven cattle were immunised at Yeerongpilly and 194 at Oonoonba. Two hundred and twenty-three steers were immunised and sold as bleeders.

Further work indicated that the two weeks immunisation procedure mentioned in the 1957-58 Annual Report had some practical disadvantages, so the usual 4-weeks method is still being used.

The markedly increased sales of tick fever vaccine can probably be correlated with the increased number of outbreaks of tick fever diagnosed during the year.

Several owners have requested that *Anaplasma centrale* be included in tick fever vaccine. In addition, over 2,000 doses of blood containing only *A. centrale* were sent to the Philippines.

VACCINES

The number of doses of vaccine supplied during the year is shown in Table 2.

TABLE 2

NO. OF DOSES OF VACCINE SUPPLIED

Vaccine	Yeerongpilly	Ooonoonba	Total
Bovine contagious pleuropneumonia	227,525	280,975	508,500
Infectious laryngo-tracheitis ..	80,400	..	80,400
Brucella abortus (Strain 19) ..	9,396	..	9,396
Tick fever blood ..	68,217	13,958	82,175

The heavy demand for tick fever vaccine noted in the 1957-58 Annual Report continued into this year, and about 30,000 more doses were distributed than in the previous year. The vaccine figures represent 411 litres or approximately 90 gallons of blood, packaged in quantities varying from a single dose of 5 c.c. to 1,200 doses.

Infectious laryngotracheitis vaccine was made and supplied by the Animal Research Institute as a freeze-dried preparation. It is unfortunate that there are no commercial manufacturers of vaccine in Queensland who could supply this vaccine. It is undesirable that highly virulent strains be used here until infectious laryngotracheitis strains of high virulence are isolated in Queensland. During the preparation and testing of vaccines many problems not normally encountered in a Research Institute must be solved.

STAFF

The staff at Yeerongpilly as at the end of June 1959 consisted of the Director of Pathology, a Senior Bacteriologist, a Senior Parasitologist, 3 Pathologists, 2 Bacteriologists, 1 Histopathologist, 1 Protozoologist, 1 Serologist, 1 Parasitologist, 1 Senior Laboratory Technician, 15 laboratory assistants and attendants and 16 ancillary staff. At Ooonoonba, the staff included Officer-in-Charge, a Pathologist, a Laboratory Technician and 6 ancillary staff.

The transfer to the Protozoology Section of Mr. L. L. Callow after two years post-graduate study at the University of Queensland Veterinary School and the re-organisation of staff within the laboratory have enabled research on the cattle tick and tick fever to be greatly increased.

The two officers who perform the complement fixation test for the diagnosis of bovine contagious pleuropneumonia at Yeerongpilly and Ooonoonba visited the C.S.I.R.O. Animal Health and Production Laboratory at Parkville in Victoria. Besides discussing the serological diagnosis of contagious bovine pleuropneumonia they also obtained information on the application of serological tests to other animal diseases with officers in southern laboratories.

The Director attended the Fourth Meeting of the Technical Committee on Infertility in Dairy Cattle held in Sydney in April 1959 and the First Poultry Convention in February 1959.

The Senior Parasitologist visited Canberra in June 1959 to attend the Seminar on Problems of Insect Resistance.

VISITORS

As in previous years, the laboratories were hosts to a number of visiting scientists, and in addition, arranged for groups of students to be conducted over the laboratories and to obtain extra-mural training. Visitors take up a considerable amount of time but the contacts made and information obtained from workers in the scientific field from other laboratories are very important.

ACCOMMODATION

Laboratory space was not increased during 1958-59, and considerable ingenuity had to be applied to organise satisfactory accommodation for the various sections to cope with increased work.



Plate 30.—Guinea-pig Stock Pen in the Laboratory Animal House at the Animal Research Institute.



Plate 31.—Mouse Room in the Laboratory Animal House at the Animal Research Institute.

The diagnosis of a viral disease of horses during the year greatly taxed the facilities for holding large experimental animals. Fortunately, stalls formerly used for laboratory animals were released by the completion of the new laboratory animal house and one of the buildings used for cattle was modified to accommodate experimental horses. Plans were submitted for an isolation building to house large animals.

The holding capacity of the library was increased by the installation of movable steel shelving in place of the fixed wooden cupboards.

HUSBANDRY RESEARCH BRANCH

The year under review, which is the second year since the formation of the Branch, would normally have been one of consolidation. This has only been possible to a limited extent, because of a reduction in the already small number of graduate staff. One Husbandry Officer resigned during the year and has not yet been replaced. Mr. J. G. Morris, Husbandry Officer, was granted 2½ years' leave of absence in order to accept a graduate assistantship in the Department of Animal Husbandry at the Utah State University, U.S.A. Mr. Morris is undertaking post-graduate studies in animal nutrition, physiology and biochemistry. The additional training and experience gained by this officer will be of considerable benefit to the Branch after his return.

The extension of the bull-proving project to include the A.I.S. breed, together with the increased number of Jersey bulls held at the Rocklea Animal Husbandry Research Farm, has considerably reduced the cattle accommodation for nutrition experiments involving measurements of individual feed consumption. Twelve small concrete pens have been built to partially relieve the position. However, the obtaining of suitable land for an artificial insemination centre is now urgent if nutrition work is to continue at a satisfactory level.

A lease of 311 acres of land at Strathpine has recently been obtained from the Co-ordinator General's Department. This land will be available for 8-10 years and will be used initially for the breeding of cattle to obtain calves and weaners for experimental work. It is planned to commence some studies on supplementary feeding of young cattle on this property at a later date.

During the year a field day was held in conjunction with the East Moreton Dairy Extension Advisory Committee. In addition, many visits were made by individuals and groups such as Junior Farmers' Clubs, Colombo Plan students and students from the Queensland Agricultural High School and College.

The experimental treatments and body-weight changes are shown in Table 1.

TABLE 1

EXPERIMENTAL TREATMENTS AND BODY-WEIGHT CHANGES IN MAIDEN HEIFERS FED CRUSHED GRAIN SORGHUM AT THE RATE OF 3LB. PER HEAD PER DAY

Group	Feeding Regimen	Body Weight (lb.)			
		Initial pasture weight	Commencement of grain feeding	After 26 weeks' grain feeding	After 9 weeks on pasture
I.†	Daily	536	457	352	520
II.*	Daily	550	464	381	530
III.†	Twice-weekly	547	462	364	560
IV.	Weekly	542	464	335	540

* Salt (0.5%) was included in the grain fed to Group II.
† During the period of grain feeding one animal died in each of Groups I. and III.

It will be noted that much weight was lost during the 3-weeks' period of change from pasture to the all-grain ration. Much of this loss was due to reduction in gastro-intestinal "fill". Animals in all groups lost considerable weight during the 26 weeks of grain feeding, most of this occurring in the first 16 weeks. The animals were moderately strong at the end of grain feeding and quickly gained weight when returned to grazing.

Animals in the twice-weekly fed group lost less weight during grain feeding than the other two groups not receiving salt. At the conclusion of grain feeding they were more active than any other group and had significantly higher blood haemoglobin concentrations, packed cell volumes and red cell counts than the animals fed daily. They ate their full ration at each feed within 90 minutes and showed little evidence of digestive disturbances. When returned to pasture they regained their initial weight before any of the other groups.

Experimental work has continued on drought feeding of cattle, copper metabolism of cattle and sheep grazing paspalum pastures at Rocklea, utilization of bagomolasses and molasses-urea mixtures by cattle, and a comparison of rotational and fixed grazing of predominantly paspalum pastures. Studies have begun on the digestibility of wheat and sorghum by pigs, feeding of dairy calves on dry meals, and supplementation of weaner cattle during winter. Many of these investigations are carried out in collaboration with the Biochemical Branch.

The Branch is responsible for the collection, processing and distribution of semen used in the bull-proving project. In addition, the Department commenced a small experimental and training artificial insemination unit in the Samford area on June 16, 1959. The semen for this unit is being supplied by the Branch.

NUTRITION

Drought Feeding Experiments

Maiden Heifers.—In the 1957-58 Annual Report, the results of a preliminary experiment on the feeding of restricted amounts of crushed sorghum grain to beef-type heifers were reported. These animals had been fed in individual stalls. The work was extended to study this method of drought feeding under yard conditions, to compare daily and intermittent feeding, and to determine the effect of inclusion of 0.5 per cent. salt with the grain.

Forty maiden Hereford heifers, approximately 16 months of age, were allotted to four comparable groups of 10. The animals were transferred from pasture to bare yards and all grain feeding was established over a period of three weeks by feeding a gradually decreasing amount of lucerne chaff and an increasing amount of grain. All were then fed crushed sorghum grain, at the rate of 3 lb. per head per day, for a period of 26 weeks. Ground limestone (1 per cent.) was mixed with the crushed sorghum grain fed to all animals. At the conclusion of the grain-feeding period the animals were turned out on paspalum pasture.

The weekly-fed group was more active than the two daily-fed groups, but lost more weight. Most animals in this group had digestive upsets after their first weekly feed, which was consumed in less than eight hours, but thereafter took 3-4 days to consume their ration and showed no ill-effects.

Although the group receiving 0.5 per cent. salt mixed with their grain lost less weight during the grain-feeding period, some animals showed oedema of the sub-maxillary region at the end of the grain feeding and animals in this group gained weight at a slower rate when returned to grazing. Studies are now in progress on the effect of higher levels of salt on heifers fed 3 lb. of grain per head per day.

Observations made during the experiment indicated that earth eating was common in all groups. Rumination ceased within the first week of all-grain feeding and all animals were observed ruminating again within 48 hours of their return to pasture.

Under the conditions of this experiment, the general conclusions that can be made are:—

- (a) Maiden heifers, when fed a restricted ration of crushed sorghum grain in a confined area with access to water, will have a high survival rate for periods up to six months. The heifers lose considerable body weight when fed at the rate of 3 lb. per head per day, but gain weight quickly when returned to fair-quality pasture.
- (b) Twice-weekly feeding appeared most satisfactory. In addition to the advantages mentioned previously, this system would require less labour than daily feeding. The twice-weekly fed heifers eat their ration quickly and there would be less opportunity for rodents or birds to consume grain than when they are fed weekly.
- (c) Although grains are low in sodium and chloride there was no advantage, at the level of grain fed, in supplementing with 0.5 per cent. salt.

Pregnant Cows.—There is considerable evidence that pregnant and lactating cattle suffer the highest mortality during droughts. It is planned to investigate this aspect of drought feeding and an experiment is now in progress to study sorghum silage alone and with two levels of urea supplementation as a drought fodder for pregnant animals.

Utilization of Cane Sugar By-Products

In Queensland, from an average production of 270,000 tons of molasses, approximately 37,000 tons are used as stock feed. In addition, large amounts of bagasse are produced as a by-product of the sugar industry. Some of this bagasse is used as fuel for furnaces in the sugar mills, but much is burnt as a waste product.

A number of studies have been made during the year on the use of these by-products as feed for cattle. These have included the use of bagomolasses (a mixture of 70 parts of molasses and 30 parts of bagasse) as the main roughage in a "topping-off" ration for cattle and studies on the responses obtained when cattle are supplemented with molasses alone or with molasses and urea mixtures. The effect of different mixtures of molasses and urea and different systems of supplementation was also examined.

Bagomolasses Fattening Experiment.—Investigations were made into the use of bagomolasses as the basis of a fattening ration for cattle. The addition of bagasse reduces the feeding value of molasses and thus makes the product unsuitable for transport over long distances, but the consistency of the mixture makes it an ideal base for a hand-fed ration.

Three rations were tested for suitability for fattening. These incorporated two levels of energy and two levels of protein. All rations contained high levels of bagomolasses. They are set out in Table 2.

TABLE 2
RATIONS USED IN BAGOMOLASSES FEEDING TRIAL

Composition	Ration		
	I	II	III
Bagomolasses (70/30) (%)	70	70	50
Meatmeal (%)	10	8	5
Urea (%)	1	..	1
Sorghum Meal (%) ..	12	15	37
Lucerne Chaff (%) ..	5	5	5
Coarse Salt (%)	2	2	2
Starch Equivalent (estimated)	39	40	49
Crude Protein (%) ..	13.5	9.8	13.2
Estimated Digestible Crude Protein (%)	9.3	6.1	8.9

Three groups of five Hereford steers, with an average initial body weight of approximately 750 lb., were fed for a period of 17 weeks on these rations. Body-weight gains were satisfactory in Group III only, being 1.4, 1.5 and 2.3 lb. per head per day for Groups I, II and III respectively. These low gains could be partly attributed to the long time taken for Groups I and II to reach an adequate feed intake, their mean daily intakes being 18.0 and 16.9 lb. per head per day respectively, while that of Group III was 22.4 lb.

A control group of steers was slaughtered at the commencement of the feeding period. The carcasses of these were compared with those of the three fed groups, on the basis of total weight and weights of ether extract, protein, water, and separable bone. Groups I and II each gained an average of approximately 120 lb. in carcass weight, while Group III gained an average of 190 lb. during the 17-weeks' period. Group III had a greater percentage of fat than the other two groups.

Some observations of importance were:

- (a) Cattle on the higher energy ration (ration III) were ready for slaughter after three months' feeding, while those on rations I and II were not ready until four months.
- (b) In commercial feeding, a more gradual introduction of the ration and elimination of poor feeders would be desirable.
- (c) The estimated level of digestible crude protein of 6.1 per cent. for ration II was sufficient for that ration.
- (d) The high level of molasses (50 per cent.) in rations I and II caused no digestive upsets, but did not allow the incorporation of enough grain to provide a satisfactory energy level.

It is considered that bagomolasses can be incorporated in a fattening ration to the level of 50 per cent. and allow adequate feed consumptions and weight gains. In this State, the economics of such a practice are dependent on many factors, but at the prices prevailing at the time of this experiment the practice would probably have commercial possibilities. However, because of the high cost per feed unit of transport of the bagomolasses the procedure is only likely to be practicable close to sugar mills.

Molasses as a Pasture Supplement.—As a supplement to poor-quality pasture, molasses can be fed either alone or as a carrier for nitrogenous supplements such as meatmeal and urea. By itself, molasses has been used to some extent as a supplement for grazing cattle in Queensland. It has been fed either free-choice or in restricted amounts. However, there is no information obtained under controlled conditions on the amount of molasses which is consumed under free-choice feeding by grazing cattle and on the production response obtained.

During a period of 10 weeks in late winter, 12 Hereford breeders grazing paspalum pasture at Rocklea were supplied with molasses free-choice. A comparable control group was not supplemented. Group intake of molasses was recorded daily, while individual intakes were measured during a 2-weeks' period by the addition of chromic oxide to the molasses and the obtaining of faecal samples for analysis.

The average molasses intake was 7.9 lb. per head per day. The estimated maximum daily intake for any animal as determined by the chromic oxide method was 16 lb., although most animals consumed an amount approximating the average intake.

Under these conditions, there was no response to the molasses supplement as indicated by body weight. The result is similar to that recorded in the Annual Report for 1956-57, when stall-fed animals fed low-quality hay showed no response in body weight or increase in feed intake when supplemented with limited amounts of molasses.

Supplementation of Cattle with Molasses-Urea Mixtures.—In an experiment described in the Annual Report for 1956-57, supplementation of cattle being fed a basal ration of low-quality pasture hay, with a molasses-urea mixture fed daily, resulted in increased consumption of hay and a response in body weight. Molasses alone fed at the same level showed no response.

This result would indicate that a response to molasses-urea supplementation should be obtained in cattle grazing poor-quality pastures during winter in some areas in Queensland. The method of supplementation under grazing conditions requires study before the maximum advantage can be achieved.

Comparison of Pasture Spraying and Trough Feeding.—In South Africa and U.S.A. spraying of pastures with a molasses-urea mixture is practised. To compare this method with trough feeding, a study was made on cattle grazing *paspalum* pastures at Rocklea. The commercial preparation used contained 78 per cent. molasses, 12 per cent. urea and 4.4 per cent. monosodium phosphate, and was provided at the rate of $\frac{1}{2}$ lb. per head per day. Although this experiment was in progress during winter, good rains were received during the experimental period and an adequate bulk of fair-quality pasture was always available. Under these conditions, no growth response in cattle was obtained to either of the methods used.

Unrestricted and Intermittent Feeding from Troughs.—Both daily trough feeding and pasture spraying have disadvantages. Daily trough feeding would be unsuitable for large grazing properties, while spraying of pastures requires a dense pasture sward and is time-consuming. A more convenient method would be either *ad lib.* or intermittent feeding from troughs. However, as urea is toxic and can cause death on high rates of intake, some preliminary observations have been made on toxicity under yard conditions on both *ad lib.* and intermittent feeding. In these experiments, groups of six heifers of approximately 500 lb. body weight were fed a basal ration of low-quality bush hay. Various combinations of molasses-water-urea mixtures were fed from troughs. In all cases it was found necessary to pre-mix the urea with 1.5 times its weight of water.

In the experiment on *ad lib.* feeding the concentration of urea was steadily increased each week from nil to 50 per cent. of the weight of molasses. A maximum daily intake of mixture (11.5 lb. per head) occurred when the molasses-urea ratio was 16:1. Maximum daily urea intake of 12.3 oz. per head was found when the ratio was 10.6:1. The intake of mixture and urea decreased steadily as the urea concentration increased, until when the molasses-urea ratio was 2:1 the daily intake of mixture was 2.4 lb. per head and that of urea was 8.6 oz. per head. While on this latter mixture one animal died overnight from urea poisoning. No other animal showed symptoms of urea toxicity.

These findings indicate that with *ad lib.* feeding, low concentrations of urea in the mixture result in high and uneconomic consumptions of both molasses and urea, while high concentrations are dangerous. Methods of controlling intake under free-choice feeding conditions require further investigation.

In the study on intermittent feeding, the molasses-urea mixture was fed at 4-day intervals. The concentration of the urea in the mixture was gradually increased, but the total amount of mixture fed remained constant at 4 lb. per head per feed. The time taken to consume the mixture gradually increased as urea concentration increased. When the 4 lb. mixture contained the maximum amount of urea used (12 oz.) the consumption time was approximately 36 hours. No symptoms of toxicity were seen. Further studies on intermittent feeding are planned.

Rotational Grazing Experiment

An outline of this experiment, which has now been in progress for 32 months, was given in the Annual Report for 1957-58. Two paddocks of equal areas are being grazed by Hereford heifers, one on a fixed system while the other is divided into four equal areas, around which the cattle are rotated at weekly intervals. Stocking rate in both paddocks is one beast per acre. Half of the animals in each group are maintained copper-adequate by regular intravenous injections of copper sulphate. As this is a long-term experiment, the animals are being replaced as they approach maturity.

Results to date show that the mean weight gain (0.64 lb. per day) of the cattle being rotationally grazed is significantly better than that (0.57 lb. per day) of the group on fixed grazing. Most of this difference occurred in the period June-December 1957, when the rotationally grazed group received silage, which had been conserved

from their grazing area during the previous summer. The performance of the copper-treated groups, both fixed and rotationally grazed, was better than the equivalent untreated groups. This difference is not statistically significant.

Mean gains over the whole period, ranging from 0.56 lb. for the lowest group to 0.69 lb. per head per day for the highest group, are low. This is probably due to the high rate of stocking, together with the poor growth of the animals during winter and early spring, associated with pasture inadequate in quality and quantity.

Copper Metabolism

An experiment to compare the liver copper concentrations of cattle and sheep grazing the *paspalum* pastures at Rocklea has been completed. Liver samples were obtained at approximately 3-monthly intervals by the aspiration biopsy technique.

The results of the four years of the experiment are summarised below:

- Sheep and cattle grazing this pasture show similar seasonal fluctuations in liver copper reserves. Maximum levels occurred in late summer and minimum levels in late winter and early spring.
- The sheep usually maintained satisfactory liver copper concentrations of more than 100 p.p.m., whereas in cattle the status was low. The highest average liver copper concentration in cattle was 43 p.p.m. recorded in March 1959, but the levels usually varied between 5 and 30 p.p.m.
- Pregnancy did not markedly affect liver copper reserves in either sheep or cattle.

In the years 1957 and 1958 a study was made of liver concentrations in new-born lambs and calves from animals in the experiment. Results are summarised in Table 3.

TABLE 3
LIVER COPPER CONCENTRATIONS IN NEW-BORN CALVES
AND LAMBS COMPARED WITH THEIR DAMS

Animal	Mean Liver Copper Concentration (p.p.m.)	
	1957	1958
Cows (at calving)	17	10
New-born calves	356	329
Ewes (at lambing)	103	136
New-born lambs	156	245

The results in both years indicate that at Rocklea calves have high liver copper concentrations at birth, despite the low levels in their dams. The levels in lambs at birth are slightly higher than in their dams. Biopsy of the calves at monthly intervals showed that their liver copper levels declined within 3-5 months to low levels, comparable with those of their dams.

During this work, it was found that the aspiration technique of liver biopsy was associated with a high mortality in new-born lambs. An open laparotomy technique was developed and proved satisfactory.

Early Weaning of Calves

Observations began during 1958 on the weaning of calves at four weeks of age on to a dry meal and lucerne chaff. The meal is based on cereal grains, cereal by-products and skim-milk powder. No liquid milk, either whole or skim, is fed to the calves after they are four weeks of age. To date, 25 calves have been reared using this system. When compared with accepted breed standards, the growth rate has been slightly depressed. Weight gains during the first four weeks of dry meal feeding averaged approximately 0.9 lb. per head per day for Jersey calves and 1.1 lb. for A.I.S. calves. No deaths have occurred and there has been little evidence of digestive disturbances.

Digestibility of Wheat and Sorghum by Pigs

In Queensland, large quantities of sorghum grain are usually available for use as a stock feed. Observations in the field, by officers of the Pig Section of the Pig and Poultry Branch, suggest that in some cases young pigs do not grow well when a large proportion of sorghum grain is included in the ration. Studies to compare the digestibility of wheat and sorghum by pigs were therefore commenced, in order to determine

whether or not differences in digestibility could be responsible. The sorghum and wheat used were of comparable chemical composition and the comparison was made over the three weight ranges of 40-80 lb.; 80-140 lb.; and 140-220 lb. So that comparisons could be made between weight ranges, the rations throughout the study were 90 per cent. crushed grain, 10 per cent. meatmeal, plus added vitamins A and D₃.

The results are summarised in Table 4.

TABLE 4
DIGESTIBILITY OF WHEAT PLUS MEATMEAL AND SORGHUM PLUS MEATMEAL BY PIGS

Weight Range (lb.)	No. of Pigs	Percentage Digestibility							
		Crushed Wheat and Meatmeal				Crushed Sorghum and Meatmeal			
		Organic matter	Crude Protein	Nitrogen-free Extract	Fibre	Organic matter	Crude Protein	Nitrogen-free Extract	Fibre
40—80 ..	4	89.5	90.0	92.0	21.3	89.7	82.2	93.9	87.1
80—140 ..	3	89.6	89.0	92.4	25.7	88.5	75.9	94.5	75.6
140—220 ..	3	89.1	90.2	91.3	30.2	88.7	75.9	94.0	80.9

Because of the small number of pigs used, no definite conclusions can be drawn at this stage, although agreement of results between pigs is good. The results indicate that the digestibility of the crude protein in the wheat-meatmeal ration is higher and that of the crude fibre lower than in the sorghum-meatmeal ration. There was little change in the digestibility of either ration as the pigs grew. It is intended to continue this work without meatmeal in the ration.

BREEDING

Bull-Proving Project

An important feature of the year's operations was the extension of the project to include the A.I.S. breed. The project now aims at testing four bulls of both the Jersey and A.I.S. breeds each year. The general procedure as described for the Jersey breed in the Annual Report for 1957-58 is being adopted for the A.I.S. The insemination areas are:—Jersey: Nambour-Maleny; A.I.S.: Nanango-Kingaroy. The insemination period commenced on Sept. 23 for the A.I.S. and Sept. 30 for the Jersey project. Chilled semen was used. The numbers of batches of semen despatched were Jersey 53 and A.I.S. 55.

Some relevant details of the project for 1958 are summarised in Table 5.

TABLE 5
DETAILS OF INSEMINATION AND RESULTS FOR 1958
BULL-PROVING PROJECT

Breed	Length of insemination period (days)	Number of co-operating farmers	Vol. of diluted semen despatched (ml.)	Total inseminations	Non-return rate (60-90 day)
					Per cent.
Jersey	108	46	3,810	2,152	59.9
A.I.S.	116	48	4,130	2,036	45.8

The conception rate is low by accepted standards but this is largely because, in both breeds, it is not possible to use the semen on the day of collection. The semen is used 24-80 hours after collection.

In the A.I.S. breed the conception rate was further influenced this year by the very low figures obtained with one of the bulls used. This bull was withdrawn when it became apparent that his fertility was low.

The total inseminations when compared with the volume of semen despatched illustrates the wastage of semen that occurs with the use of chilled semen. The variable demand for insemination and the limited period for which chilled semen can be used are responsible.

Although the bulls of both breeds were of comparable age, there were indications that the Jersey bulls produced a slightly lower volume of much denser semen than the A.I.S. bulls.

Deep-Frozen Semen

Deep-frozen semen is being prepared at Rocklea as an insurance against injury or death of bulls being tested in the bull-proving project. During the year, re-organisation of available space and the use of a crushed dry ice-alcohol mixture instead of dry ice alone has allowed the storage of more ampoules. Approximately 5,000 ampoules, representing semen from all bulls used during the project, are now in storage. At present the assessment of each batch of deep-frozen semen is by laboratory examination only, but the commencement of the training and experimental unit in the Samford area will permit a check on fertility by the use of some ampoules from each batch prepared.

BIOCHEMICAL BRANCH

TOXICOLOGY SECTION

Diagnostic Service

Specimens submitted for toxicological examination are of two types:—(a) those from investigations in which field evidence or autopsy findings suggest poisoning; and (b) those from deaths where ante-mortem history or autopsy findings are insufficient or unknown. Specimens from the latter type of mortality account for the high proportion of negative findings in specimens examined. Specimens were received from 296 properties on which stock deaths were investigated. Analysis confirmed arsenic as responsible for 39, lead for 12 and nitrate, selenium and hydrocyanic acid each for one poisoning.

Miscellaneous specimens examined included plants for nitrate, hydrocyanic acid, oxalate and alkaloid determinations and stock feeds for salt, urea and phosphorus content. A grassy lucerne hay consisting largely of *Urochloa panicoides* contained nitrate equivalent to 3.5 per cent. potassium nitrate on a dry-weight basis, while the *Urochloa* contained the equivalent of 4.9 per cent.

A growing awareness of the role of chemical analysis in maintaining effective dipping vat strength has led to a further increase in the number of samples submitted for analysis. Of the 1,222 samples submitted, 146 were from vats containing arsenical tickicides while the remainder were chlorinated hydrocarbon preparations.

Analytical findings indicate that oxidation in vats containing arsenical preparations is common and that in many cases the maintenance and sampling of vats charged with chlorinated hydrocarbon proprietaries is inadequate. A dip-side test designed to detect oxidation in vats containing arsenical tickicides has been made available to Departmental field officers and a collaborative article on the care and sampling of dipping vats containing chlorinated hydrocarbon preparations has been published in the *Queensland Agricultural Journal*.

Investigations

Further investigation of the selenosis problem in north-western Queensland has shown that exposure to selenium occurs outside the previously known affected area, but no clinical selenosis has been encountered.

In the area known to be acutely toxic, local stock can and do avoid the highly toxic vegetation through careful management assuring a very light stocking rate. However, the area is potentially hazardous to livestock and acute selenium poisoning occurred in a flock of sheep newly introduced into the area. A paper presenting preliminary findings on the selenosis problem in this area and in the Cape York Peninsula was published in the *Australian Veterinary Journal*.

At Bamaga in the Cape York area chronic selenosis in horses grazing the plant *Morinda reticulata* was observed previously. Horses are now mustered off areas carrying *Morinda reticulata* during the period of regrowth and no clinical cases of "alkali"-type selenosis occurred during the last year.

Investigation of the active principle of poison plants was confined to work on *Acacia georgina* (gidyea). Findings indicate that more than one toxin is present in the plant and work is in progress to determine which of these is responsible for Georgina River disease.

BIOCHEMISTRY SECTION

Diagnostic Service

Blood inorganic phosphate analyses were done on 1,001 samples from 174 different cattle properties. On 51 of these properties a diagnosis of phosphate deficiency was confirmed, while on 33 other properties the phosphate status of livestock was deemed marginal. Plate 32 has been compiled from data on diagnostic samples submitted during 1958-59. Each dot represents the location of a property in which phosphate deficiency in livestock was confirmed during the year.



Plate 32.—Cases of Phosphate Deficiency Were Recorded In 1958-59 from the Places Marked by Small Dots.

Liver analyses were done on 141 samples representing 77 cattle properties. On 22 of these properties a diagnosis of copper deficiency was confirmed.

Blood copper levels were determined on 779 samples representing 115 other properties. A diagnosis of copper deficiency was confirmed on 18 properties, while the blood copper status of livestock on a further five properties was marginal.

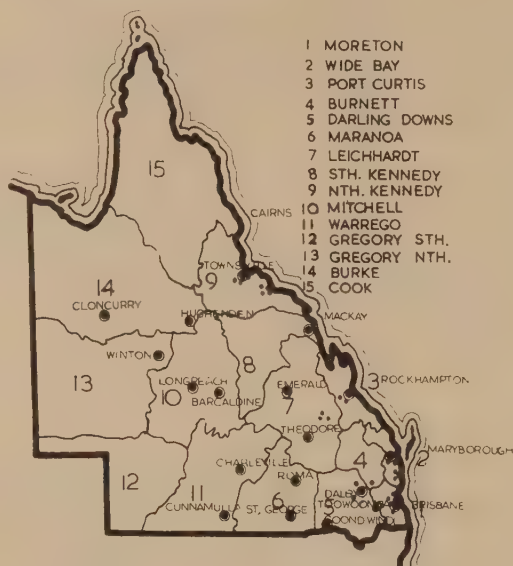


Plate 33.—Cases of Copper Deficiency Were Recorded in 1958-59 from the Places Marked by Small Dots.

Plate 33 has been compiled from data on diagnostic samples submitted during 1958-59. Each dot represents a property on which copper deficiency was diagnosed in livestock during the year.

Serum calcium was determined on 111 bovine sera from 70 properties. Hypocalcaemia was evident in animals from 15 properties. On 81 of these sera from 56 properties, serum magnesium was also determined. Eleven cases of hypomagnesaemia and nine cases of hypermagnesaemia with associated hypocalcaemia were recorded.

Liver vitamin A analyses on 39 commercial poultry farms established that the fowls on eight of these were deficient in vitamin A and that on seven other farms the vitamin A status of the fowls was marginal. Of 34 pig livers examined for vitamin A, two had a marginal level of the vitamin and the remainder had adequate reserves.

Of the 2,250 miscellaneous samples analysed, most were in the field of clinical biochemistry associated with animal health. Analyses included the determination of blood haemoglobin and haematocrit, differential serum protein analyses, and riboflavin and thiamin determinations. In the province of animal nutrition, the feeding value and quality of pastures, silages, hays and other feedstuffs were determined and other specific inorganic dietary factors were estimated in feedstuffs.

Investigations

Copper.—(1) Studies on copper metabolism were continued at the Rocklea Animal Husbandry Research Farm. Trials in which both Merino sheep and Hereford cattle graze comparable paspalum pastures continued for another breeding season. The results obtained are similar to those in previous years, namely, ewes maintain moderate copper reserves and adult cattle have very low copper reserves. Pregnancy does not markedly influence the copper status of the dams of either species, and lambs and calves have adequate liver copper reserves at birth. As judged by liver biopsy samples, lambs maintain a liver copper level similar to that of their dams (200 p.p.m. copper in dry matter). Calves again this season showed a rapid depletion of copper reserves. An average level of 330 p.p.m. copper in dry matter was depleted to 30 p.p.m. copper in two months and 15 p.p.m. copper in four months.

(2) Previous pen trials to examine dietary factors which interfere with copper metabolism in cattle on a predominantly paspalum diet have shown that (a) the interfering factor is not related to the molybdenum content of the paspalum, and (b) its effect varies with the protein content of the paspalum. Paspalum hay of uniform protein content has replaced freshly cut paspalum as one of the experimental diets in this season's pen trials.

(3) A grazing trial involving groups of cattle on set stocking and rotational grazing includes sub-groups that are kept copper-adequate by intravenous injection of copper sulphate. In both groups the copper-treated sub-groups continue to make slightly better relative weight gains than the untreated sub-groups.

(4) The uptake by paspalum pastures of copper supplied as copper sulphate was examined at Rocklea. Plots each of 36 sq. ft. were treated by foliar spraying or dusting at rates equivalent to 0, 7, 14, 28 and 56 lb. copper sulphate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) per acre. Each plot was subdivided, one half being sampled at monthly intervals while the other half was mown after each monthly sampling if growth was sufficient.

Findings for the spray application of copper sulphate were:—

- The 28 and 56 lb. per acre applications were somewhat phytotoxic.
- The copper content of the pastures varied with the rate of application and high levels of copper were induced in pastures on all plots.
- Pastures on all plots, because of a high copper content, were not fit for grazing until five months after spraying, but the levels in pasture were then only 1.4 p.p.m. copper above the 8 p.p.m. in untreated pastures.
- At this period the copper content of new growth following mowing was slightly above that of pasture on unmown plots.

Where copper was supplied as a dust the levels in pastures on all plots were markedly below those induced in sprayed plots. Findings for the dry treatment with copper sulphate were:—

- One month after treatment the levels of copper in pasture on all plots were only slightly increased, the increase varying with the application rate.
- Two months after dusting there was no significant difference in copper content between the pastures on all plots and the levels induced were only 1.2 p.p.m. above those in pasture on untreated plots.
- As in the spray treatment, levels were slightly higher in regrowth following mowing.

Phosphate.—Regressions relating the phosphate, calcium and protein levels in diets selected by grazing cattle and those in the resultant faeces have been developed. These regressions have been used to aid two studies on the nutritional status of grazing animals.

(1) In an area characterised by an acute aphosphorosis, particularly in newly calved cows, these studies have shown that important factors are:—

- The diet selected during late pregnancy is moderately low in phosphorus.
- The stress of pregnancy and lactation depletes phosphate reserves.
- Post-parturient grazing of sown crops provides a diet with a wide calcium: phosphorus ratio.

(2) A grazing trial was conducted in which foliar application of a commercial preparation containing 78 per cent. molasses, 12.5 per cent. urea and 4.4 per cent. monosodium phosphate was used to supplement poor quality grazing. Due to unusually favourable seasonal conditions, control groups grazing unsupplemented pastures made weight gains at a period when weight losses are normal. Use of the regression previously developed showed that the diet selected by this group contained approximately 10 per cent. protein, whereas the pasture as analysed from quadrat samples contained 6 per cent. protein. This trial is being repeated during the current season.

Biochemical observations on long-term phosphate supplementation trials have continued in some of the areas in which cattle are known to be deficient in phosphate. Supplementation methods used are:—

- Pasture top-dressing with superphosphate.
- Soluble phosphate added to drinking water.
- Phosphate supplied as bonemeal licks.

Gross Protein Value.—Previous trials on the effect of vitamin E supplementation to chickens receiving rations containing animal protein from various sources have emphasised the need to investigate the quality of the protein in the meat-and-bone meal.

Standard biological methods for evaluating the quality of supplementary proteins for chickens were adopted. The number of replicates per treatment and the number of chickens per group satisfied statistical requirements and were in excess of the numbers normally used in such testing.

Initially, meat-and-bone meals (A) and (B) were compared twice in separate trials. A third trial using rations mixed for the previous trials was conducted 5-6 months later. Table 1 presents the gross protein values obtained in the three trials using test rations mixed in October 1958.

TABLE 1
GROSS PROTEIN VALUES OF MEAT-AND-BONE MEALS

Meat-and-Bone Meal	Gross Protein Value		
	Oct.-Nov., 1958	Nov.-Dec., 1958	Mar.-Apr., 1959
A	105	103	68
B	90	90	47

Work is now in progress to examine whether an increase in indigestible animal protein due to storage has occurred and whether oxidative changes in the fat in the meat-and-bone meals have reduced palatability. The effect of using different breeds of chickens to determine gross protein values by this technique is also being examined.

Drought Feeding Experiments.—The results of drought-feeding experiments with which this Branch was associated are detailed in the Annual Report of the Husbandry Research Branch. However, biochemical values obtained in these experiments warranted further investigational work with beef cattle. Two trials in progress are:—

- The effect of increased sodium chloride intake on cattle on a low plane of nutrition. In this trial, six maiden heifers are each fed 3 lb. of sorghum grain per day. The effect of the ingestion of varying levels of salt is being assessed by biochemical studies on these animals.
- Normal biochemical values for beef cattle. There are few data on plasma electrolyte levels and plasma and extracellular fluid volumes in beef cattle available in the literature. In addition, changes in haemoglobin percentage, red cell count, haematocrit, blood inorganic phosphate, prothrombin time, serum protein, calcium and magnesium are not well defined. Six Hereford calves at the Rocklea Husbandry Research Farm are being examined at 2-monthly intervals to determine these values. This is a long-term project.

Conserved Fodder.—Experimental tower silos of $\frac{3}{4}$ ton capacity have been used to produce paspalum silage. Paspalum pasture cut into 1-3 in. lengths by a forage harvester had been conserved alone and with additives. Additives used were sodium metabisulphite and molasses. The former was added at 8 and 16 lb. per ton of green pasture and the latter at 40 and 80 lb. per ton. An evaluation of these silages in terms of quality, palatability and feeding value has begun. This is an extension of a trial reported previously.

Digestibility trials using sheep as experimental animals to evaluate urea as a supplement to sorghum silage have been completed. Findings are as follows:—

- (a) Sheep are in negative nitrogen balance on a diet of *ad lib.* sorghum silage.
- (b) The addition of 14.5 g. urea per day per sheep to the silage ration did not correct the negative nitrogen balance.
- (c) The addition of starch to the silage-urea ration produced a positive nitrogen balance.
- (d) Sorghum silage to which urea had been added at the time of ensiling (18 lb. urea per ton green material) was similar in silage quality to untreated silage.
- (e) The nitrogen balance obtained on feeding this silage was similar to that obtained when urea was added to the silage when fed.
- (f) This silage responded similarly to the addition of starch and produced positive nitrogen balances in sheep.

SHEEP AND WOOL BRANCH

EXTENSION WORK

Figures which show the numbers of times on which field officers have given advice and demonstrations of various methods of sheep husbandry have been taken out for the period under review. These show an increase on previous years and indicate an appreciation by graziers of the service supplied to them by field officers.

An analysis of the figures for extension work reveals that 73 per cent. of the total work performed by field officers during the year was devoted to sheep breeding and parasite control. The remaining 27 per cent. was devoted to sheep feeding, marketing and land utilization.

It is probable that seasonal conditions and the prevalence of blowfly resistance to the chlorinated hydrocarbons had some bearing on the large number of requests by graziers for advice in respect of parasites. It does seem, however, that owners are becoming increasingly aware of the fact that the health of the sheep is of paramount importance when it comes to increased lambings and higher wool cut per head. Again, it appears that graziers are becoming increasingly aware of the importance of their breeding programmes. This is borne out by a study of the increased amount of extension work performed by field officers relating to this aspect of sheep husbandry.

Advice and demonstrations in the selection and mating of breeding flocks have been linked with the weighing of fleeces for accurate classing. This, coupled with the taking of mid-side samples of wool for submission to the Fleece Testing Laboratory, should do much to increase both the quantity and the quality of wool produced by flocks, thereby increasing production without increasing costs.

With the advent of lower wool prices and serious competition from synthetics, graziers will need to keep to a minimum, where possible, production costs. Many of the items which are included in production costs are possibly beyond their control. Nevertheless, any increased production that can be secured at no extra cost is a means to this end.

FIELD DAYS

In addition to advice and demonstrations in the various aspects of sheep husbandry, officers participated in 17 field days. These days, apart from the general information imparted, serve as a means of bringing graziers together under conditions where they are able, at question time, to request information in respect of their own particular problems. They also serve as a useful method for field officers to make contacts which might not otherwise present themselves.

SCHOOL FOR COLOMBO PLAN FELLOWS

A short school was conducted in June for 14 Colombo Plan Senior Fellows from India. At this school an attempt was made to show the methods used at producer schools. Among other things, the Colombo Plan Fellows were instructed in methods used in the Fleece Testing Laboratory and all had the opportunity to physically carry out, under guidance of laboratory staff, the various techniques used.

WOOL BIOLOGY LABORATORY

The dry conditions existing in some of the State's sheep areas caused a slight reduction in the number of wool samples received during the first half of the year, but there was an increased submission of samples during the second half.

A total of 3,823 wool samples was received at the laboratory, and 3,127 samples were measured for fibre diameter, crimp and staple length. The latter figure is about twice the number of similar measurements made in the previous year and indicates that sheep owners are making more use of these measurements when making their final selections of breeding stock.

EXTERNAL PARASITES

The organic insecticides again proved their usefulness in the control of body lice. There were some outbreaks of leg itch mite (*Trombicula sarcina*). A number of cases of itch mite (*Psorergates ovis*) were diagnosed, particularly in the south-eastern sheep areas. There did not appear to be any increase over previous years in the incidence or the intensity of the attacks.

In the case of the blowfly, further field evidence of resistance to the chlorinated hydrocarbons was obtained. Reports of apparent resistance were received from widely scattered areas throughout the sheep country.

Strains of *Lucilia cuprina* which appeared to be resistant to the chlorinated hydrocarbons under field conditions were collected from the central and south-western areas. Laboratory tests at the Animal Research Institute showed that these strains are highly resistant to dieldrin and endrin. They also have developed some increased resistance against benzene hexachloride, but they show no increased resistance to DDT or diazinon.

The appearance of hydrocarbons-resistant flies in widely separated sheep areas brought about a return to crutching as a method of protection against crutch strike. There was also some increase in the number of sheep on which the Mules operation has been performed, but owing to the long and persistent autumn blowfly wave and the persistence of the black fly (*Musca vetustissima*), it was necessary to delay the Mules operation well into the winter. It is encouraging to see a return, for the control of blowfly, to those principles which bring about on the sheep an environment unsuitable to the existence of the blowfly, i.e. make the breech of the sheep clean and dry. It is, perhaps, opportune to recall that in the early stages of blowfly control investigations it was found that wrinkly and very wrinkly sheep were struck more frequently than plain-bodied sheep. It should be remembered, however, that correct tail length, the tail strip operation, and the Mules operation increase the resistance of all classes of sheep.

INTERNAL PARASITES

The suitability of Queensland temperatures for outbreaks of internal parasites has been amply demonstrated by the finding of heavy infestations of barber's pole worm (*Haemonchus contortus*) in sheep in the northern portion of the drought-stricken south-western corner. In these areas, it would appear, the moisture along bore drains is sufficient to allow the eggs to hatch and the larvae to survive. Heavy grazing of the short green grass along the bore drains leads to a marked increase in the stocking rate, with increased opportunities of ingesting the infective larvae of the worm and so building up a heavy infestation in sheep in drought-stricken country.

MULGA FEEDING

During the drought in the south-western portion of the sheep country large numbers of sheep were kept alive by feeding on mulga (*Acacia aneura*). The feeding of mulga has presented some problems. Efforts have been made to make sure that suitable stands remain for future droughts. In very thick stands this could be accomplished by knocking down and completely destroying some trees, but leaving sufficient trees to produce maximum foliage after the drought. Where supplies were limited it was necessary to give all trees a good chance of survival and this was accomplished by knocking down most of the branches and leaving only a few laterals. Consequently a wide variety of machines were (and in some cases still are) used. Bulldozers were very useful in the heavily timbered country. Front-end loaders on tractors were very useful and economical on the more sparsely timbered country, where it was necessary to preserve the trees.

In general, flocks were maintained in low store condition. In some cases outbreaks of barber's pole worm occurred in the northern mulga areas, and consequently further loss of condition occurred.

Mulga is low in phosphate and high in lime. On a dry matter basis the phosphoric acid content is about 0.15 per cent. and lime (calcium oxide) content about 1.5 per cent. After sheep had been on mulga for a few months it was suggested that they be fed a phosphate-rich lick. Though it was not possible to keep any control sheep those owners who fed such a lick generally agreed that the feeding of a phosphate supplement improved the condition of the sheep.

TOORAK FIELD STATION

At the Toorak Field Station the following investigations are in progress:—

(1) *The effect of cutting native pasture, at different stages of growth, on the botanical composition.*—This investigation was commenced with two objects in view:—

(a) to find the effects on the botanical composition of cutting pasture for bush hay; and

(b) to simulate the grazing pressure on native pastures at various stages of growth. Both these investigations are long-term and are being done in conjunction with the Agriculture Branch.

(2) *Sown Pasture—Nursery Plot.*—During the last two years the Agriculture Branch has endeavoured to introduce new plants into the Station nursery plot. These plants have been introduced under normal climatic conditions without the aid of irrigation.

(3) *Fodder Crop Nursery.*—Methods of alleviation of drought losses are as yet not well established. The purchase of fodder and its transport during drought is almost always costly and, if carried on for a prolonged period of time, uneconomic. Some crops are already grown for fodder in western sheep areas, but the quest for better fodders needs to be continued. The fodder crop nursery was established with this object in view.

(4) *Length of Fallow and Row Spacing Trial.*—An experimental area was established to evaluate the effect of row spacing on sorghum crops. The trial has also been set up to investigate the effects of varying lengths of fallow. Results from this trial will not be useful until a number of varying seasons have been encountered.

(5) *Blowfly Control Trial.*—A blowfly control trial was attempted during the late summer and autumn of 1959. The sheep used were 215 uncrutched,

unmulesed August/September 1957 drop hoggets and 51 March/April 1958 drop weaners. One hundred sheep were treated with 0.04 per cent. Dicapthon and the remainder served as untreated controls. The sheep were jettied on February 10, but no fly strike was recorded until April 1. By April 6 there were 16 blowfly strikes on the Dicapthon treated, and 19 control sheep struck. All except two of these strikes were confined to the breech area. None of the strikes in treated or control animals were extensive. This trial would indicate that Dicapthon at 0.04 per cent. had lost its insecticidal value under these field conditions some time before the small fly wave occurred, i.e. eight weeks after treatment.

(6) *Ram Fertility.*—An attempt is being made to evaluate the fertility of 17 rams over a 12-month period at the Toorak Field Station. Locally bred rams were used and they were about 22 months old when first used. Semen samples were obtained by electrical stimulation. Samples collected from August 1958 to June 1959 were examined for motility, pH, percentage of abnormal spermatozoa, live and dead staining. Though there is an indication that the semen obtained at the June 1959 sampling is generally of a higher quality than that obtained during the previous 10 months, there was no marked trend during the previous monthly samples. It will be necessary to continue examination of semen for a further year to evaluate seasonal influence on semen production. Electrical stimulation may give a false indication of the nature of semen produced by the ram and it is desirable that this method be complemented by collecting samples following natural service.

(7) *Joining and Lambing Trial.*—The nucleus flock at the Toorak Field Station is maintained to yield information on the lifetime production and fertility of a strain of sheep typical of those run in this area. At joining time in 1958 it consisted of the surviving foundation stock born in 1950 and their progeny dropped over the years 1953 to 1956. When a few ewes already in lamb were excluded, 671 ewes were effectively present during joining, which extended from March 26 to May 6, 1958. Over this 6 weeks' period the ewes were run daily with raddled vasectomised rams for at least one hour. Ewes detected by this means as showing oestrus were mated by hand service under observation. Fourteen selected rams were used and the allocation of ewes to rams was made at random.

Over the whole flock the number of ewes showing oestrus was high—90 per cent. The lowest figure was 85 per cent. for the old (1950 drop) ewes. Immediately after joining the ewes were run with vasectomised rams for a further three weeks. Of the ewes which had been served, 65 per cent. did not exhibit oestrus and were assumed to have conceived. The ewes lambing under observation from late August to mid-October. Of 318 ewes that lambed, 51 gave birth to twins. In general, the lambing percentage showed a tendency to increase with age. This trend is not due to culling, as this cannot be practised in a flock in which lifetime observations are being made. The following table shows the percentage of ewes lambing in each age group:—

Age of Ewes at Lambing Years	Number of Ewes Lambing
8	108 = 57%
5	18 = 31%
4	151 = 49%
3	13 = 36%
2	28 = 34%

A total of 239 lambs was marked on Nov. 7, 1958. This represents an overall lamb marking, based on ewes present for joining, of 36 per cent.

This joining and lambing trial has indicated that the poor lambing performance of these ewes is a composite effect:—

- (1) 10 per cent. of the ewes did not show oestrus and were not served.
- (2) 32 per cent. were served, but apparently did not conceive (in some cases there may have been conception followed by early foetal resorption).
- (3) 11 per cent. apparently conceived, but failed to lamb.
- (4) 13 per cent. lambed but failed to rear a lamb to marking age.

There is, therefore, a total wastage of 66 per cent. In this particular season the survival of twin lambs was somewhat better than usual. Ten of the 51 ewes with twins reared both lambs to marking, to increase the lamb-marking percentage from 34 to 36.

The number of lambs which survived to marking as a percentage of those born is 65 per cent. Of single males and females born, 73 per cent. survived; of the twin males, 63 per cent. survived; of the twin females 44 per cent. survived; and of all twins 53 per cent. survived. Survival of lambs born to ewes with large udders was 70 per cent. while only 57 per cent. of those born to ewes with small udders survived. Of the 369 lambs born, six showed physical abnormalities; two had no lower jaw, four had twisted feet and crooked hind legs.

The average birth weight of male lambs was 7.9 lb., and of female lambs 7.6 lb. The average gestation length for male lambs was 151.3 days, and for females 151.1 days.

The majority of lamb deaths can be attributed to low birth weight coupled with inadequate milk production by the dam. The problem appears to be primarily nutritional. Questions to be answered are whether the lambing should be changed to some more favourable part of the year, and whether supplementary feeding can be made economically possible.

The rams used in this joining trial were examined for fertility prior to joining and judged to be fertile on semen samples obtained by electrical stimulation. Rams Nos 1 to 8 were 18 months old when joined, and rams Nos. 9 to 14 were 2½ years old.

The birth weights and gestation lengths for lambs sired by each of the 14 rams are as follows:—

Ram No.			Birth Weight	Gestation
			Lb.	Days
1	..	..	7.9	150.6
2	..	..	8.0	150.1
3	..	..	7.9	152.1
4	..	..	7.6	152.2
5	..	..	7.4	151.2
6	..	..	7.2	149.5
7	..	..	7.3	151.8
8	..	..	7.9	150.8
9	..	..	9.1	152.6
10	..	..	7.9	151.0
11	..	..	8.0	150.9
12	..	..	7.5	151.2
13	..	..	7.5	151.6
14	..	..	7.9	151.0

The marking weights and daily gains of the lambs sired by the various rams are as follows:—

Ram No.			Marking Weight	Daily Gain
			Lb.	Lb.
1	..	..	26.0	0.27
2	..	..	28.5	0.31
3	..	..	27.8	0.30
4	..	..	24.4	0.29
5	..	..	22.3	0.25
6	..	..	22.7	0.24
7	..	..	26.3	0.30
8	..	..	26.4	0.29
9	..	..	26.4	0.30
10	..	..	25.9	0.29
11	..	..	28.8	0.31
12	..	..	23.8	0.27
13	..	..	22.6	0.26
14	..	..	27.3	0.29

The percentage of successful services by each ram expressed as the number of ewes which lambed to service over the number of ewes served is as follows:—

Ram No.					Percentage
1	..	..	..	..	32
2	..	..	..	..	32
3	..	..	..	..	38
4	..	..	..	..	39
5	..	..	..	..	33
6	..	..	..	..	36
7	..	..	..	..	37
8	..	..	..	..	38
9	..	..	..	..	25
10	..	..	..	..	31
11	..	..	..	..	36
12	..	..	..	..	36
13	..	..	..	..	37
14	..	..	..	..	37

The comparison of ram performances shows that there are differences among rams, but these differences are not very large. There is little prospect of finding among the flock, rams of sufficiently above-average fertility to make any very marked improvement in lambing percentages. If the ram is a major cause of the poor conception rate, the problem is to raise the fertility of the average ram rather than to find an improved method of predicting the fertility of individual rams.

An examination of the records for the 1958 lambing has indicated that in this year the plain-bodied ewes were more likely to lamb than those with a high fold (or wrinkle) score. Of the ewes which lambed, those with a high fold score were less likely to rear their lamb. These observations obviously need verification by continuing observations for some years. Further examination of the results showed that it would be necessary to cull the existing ewe flock extremely heavily against wrinkles to produce any noticeable fertility response.

However, if an appreciable part of the fold score fertility relationship is genetic, then the long-term prospects of breeding for increased fertility are good. The heritability of wrinkles in Australian Merinos is known to be high and it would, therefore, be a simple matter to breed either plain-bodied or very wrinkly sheep.

The 1959 autumn joining trial was started in early April and finished in May, although the ewes continued to run with vasectomised rams until early June. The general method of handling the ewes was the same as in the previous year—the ewes were run with vasectomised rams for at least one hour per day and then run with single rams until a successful service was observed.

The ewes and rams used were divided into three groups and joined as follows:—

- Plain-bodied group of ewes mated with plain-bodied rams.
- A random selected group of ewes mated at random with plain and wrinkly rams.
- A wrinkly group of ewes mated with wrinkly rams.

The comparison of conception and lambing results from these three groups should show if the differences observed in 1958 are repeated.

The comparison of results of plain and wrinkly rams on the random group ewes should give an indication of any relationship between skin folds and fertility on the ram side.

The offspring from the joining, when they mature and are mated, will give an estimate of the genetic relationship between skin folds and fertility.

In an effort to raise the percentage of conceptions obtained by rams in this environment, half of each group has been hand-fed before and during joining. The results will give an indication of the usefulness of providing a higher plane of nutrition for a joining at this time of the year.

(8) *Adult Mortality*.—A flock of approximately 500 Peppin ewes, born in 1950, was introduced to the Toorak Field Station in 1952. These ewes were from a flock which had been bred in the district for a considerable number of years. Each year the number of ewes present at joining, shearing and lambing has been recorded. The continuous line of the graph (Plate 28) shows the number of ewes actually counted. The curve shown by the broken line is that calculated for an annual death rate of 13.1 per cent. on a similar number of sheep.

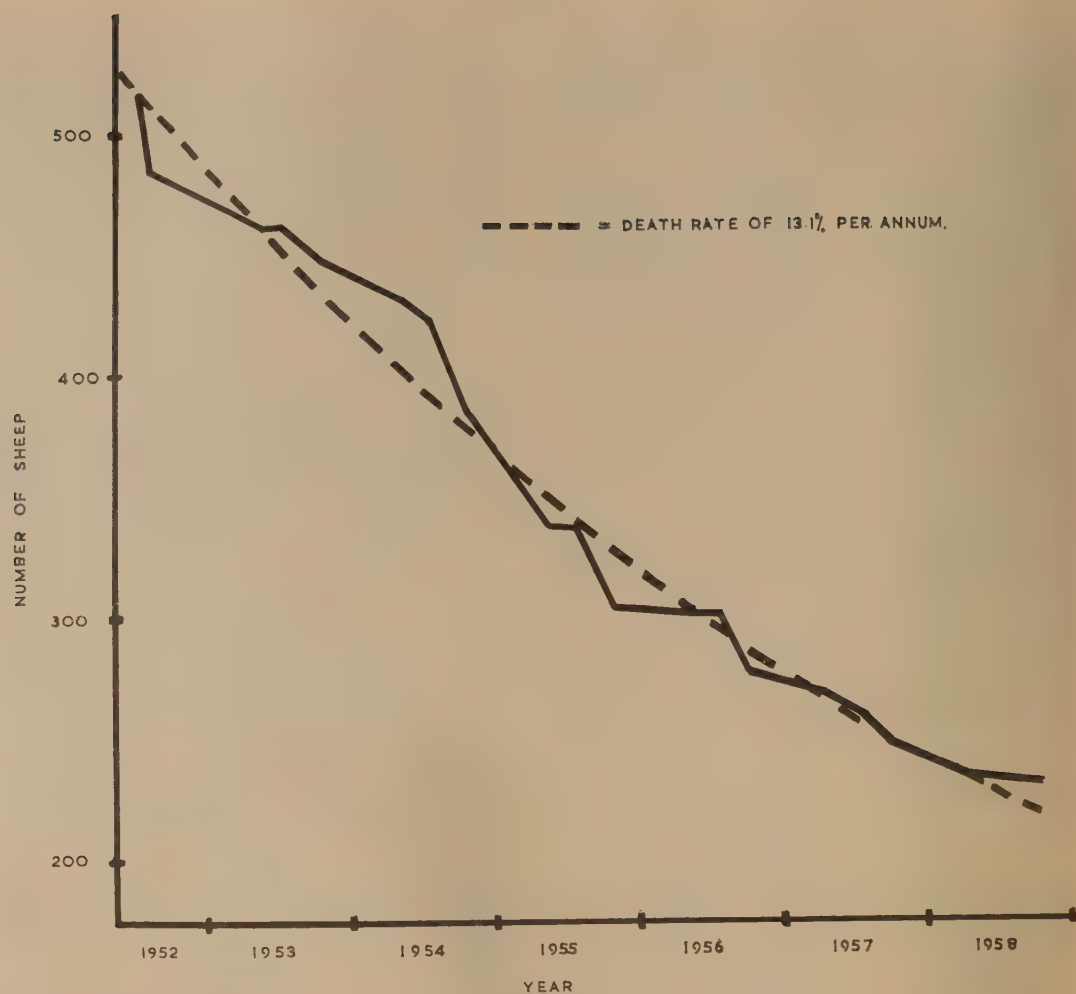


Plate 28.

CATTLE HUSBANDRY BRANCH

The functions of this Branch since its formation have been twofold. Firstly, it provides an extension service to producers in both the beef and dairy cattle industries, supplying technical information and advice on the application of the results of research work to the problems of the industries within Queensland. Secondly, it has engaged in investigational work to provide further information on various aspects of beef and dairy cattle production under Queensland conditions. The investigational work has been carried out at various Regional Experiment Stations and Research Stations and on private properties with the co-operation of individual producers.

EXTENSION

Extension is perhaps the least spectacular of the Branch functions. It attracts little popular attention and in this respect is in contrast to research and investigational work. It is, however, a primary and essential function of the Branch and the intensity of this work is mounting continuously in response to producer demand.

The planning of extension activities in a way that will make most efficient use of officers' available time and at the same time result in the channelling of such advice and information to producers as will be most useful is becoming a challenge to the organising ability of the individual extension officer and, in fact, to the Branch as a unit.

The measure of success achieved by an extension officer in his assistance programmes to the producers in his region is primarily dependent on his ability to define clearly the problems of producers in his region.

With a view to better problem definition and consequently to the origination of extension programmes that are technically sound and economically practical, meetings of staff from a particular region are being planned. The regional meeting has as its objectives the clear definition of regional problems, the consideration of those problems on the basis of available technical knowledge, and their classification accordingly. Some problems require further research, often of a local and adaptive nature; others require merely adequate definition before the promotion of extension programmes. The first 2-day regional meeting was held at Gayndah in April and was attended by Branch officers from the Burnett Region. Such short but periodic meetings achieve some measure of integration and this will be in the interest of efficiency and effectiveness of extension programmes.

The organisation and participation by Branch officers in group activities and the use, wherever possible, of the media for group contacts is a feature of extension work that is developing at an accelerating rate. Within limits it is necessary and desirable, but it is felt that it must be held to its proper proportions lest extension become a matter of mere words that are unrelated to the real problems of the industry and lest extension officers fail to seek out and assemble facts and data that will lead to clear definitions of industry problems. This is a prerequisite to effective extension activity and the necessity for it can be overlooked.

The following summarises the group activities of Branch officers during the year:—

Field days and demonstrations	84
Meetings addressed	96
News items and radio broadcasts ..	139

DAIRY INVESTIGATIONS

Regional Experiment Stations

At the *Kairi Regional Experiment Station* there is maintained on a portion of about 100 acres a Jersey herd that has for several years formed the animal factor in a demonstration of land-use methods. The integrated crop, pasture and livestock programme is basically designed to improve soil fertility and ultimately to raise the productivity of crops and livestock on the demonstration block. Maize for grain is an essential part of the crop rotation, together with crops for forage and silage and lucerne and mixed pasture.

Table 1 gives details of the performance and productivity of the dairy herd component of the demonstration block over the past three years.

TABLE 1

PRODUCTIVITY OF KAIRI JERSEY HERD

	1956	1957	1958
Total Milk Production (lb.) ..	66,880	110,450	145,622
Total Butter Production (lb.) ..	3,717	4,924	7,824
Butter per acre (lb.) ..	43	73	86
Cow-equivalents per acre ..	0.28	0.33	0.33
No. of cows	24	27	31

The herd of Jerseys is treated as a unit, and cows and replacement animals are maintained on foodstuffs produced on the block. Production per acre is considered as the critical factor and this can be improved progressively by increased productivity per cow and by increased rate of stocking. In the initial years progress has been made in both directions. The effective use of all green feed that is produced by conservation and increased breeding efficiency are avenues that should allow of greater productivity in future years. This increased animal productivity has been achieved without reduction of the maize grain output.

The demonstration block is of particular significance inasmuch as it enables a study of agronomic and husbandry methods that are appropriate for a region devoted to mixed crop and animal husbandry enterprises.

At the *Biloela Regional Experiment Station*, attention has been given to the value of silage from summer cereals. This Station is well suited climatically and geographically to studies of this nature. It has been already adequately demonstrated that bulky summer crops, notably sweet sorghum, could be grown on most holdings in central and southern Queensland. It has also been amply demonstrated that these crops are ideal for silage. It still remains important to evaluate this material as maintenance and production rations for various classes of cattle in a variety of nutritional circumstances.

Sorghum silage alone and with added protein was used in trials with weaners and yearlings. The added protein was of two types—(1) cottonseed meal, and (2) velvet bean sown into the sorghum and harvested and ensiled with it. The animals were fed generously on silage in yards so that measures of consumption could be accurately made. The object is to relate the performance of the animals to their consumption rates, having determined the nutritive value of the feeds from chemical analysis. Standards can thus be determined which will be of value to extension officers in their work with commercial producers planning feeding programmes using similar fodders.

This type of investigation wherein accurately assessed feed inputs are related to the output of livestock products is one of the most important fields for future study. It is information that is readily and quickly adaptable to commercial conditions and is essential in any economic appraisal by commercial producers of their feeding programmes.

F

Proving Dairy Bulls

Jersey Breed.—The breeding season extended from Sept. 30 to Jan. 16, inclusive, with 46 co-operators participating in the programme in the Nambour-Maleny-Kenilworth district. The number of inseminations performed and the fertility rates are presented in Table 2.

TABLE 2

DETAILS OF JERSEY INSEMINATIONS, 1958-59

Insemination	No. of Cows Inseminated	No. of Non-Returns in 60-90 Days	Conception Rate
First	1,480	897	per cent. 60.6
Second	477	275	57.7
Third	154	100	64.9
Fourth or more ..	41	18	43.9
Total	2,152	1,290	59.9

The first-insemination fertility rates between the four bulls used during the season are reasonable (Table 3) and approach the levels achieved in the first two years. (Table 4).

TABLE 3

FERTILITY RATES OF JERSEY BULLS, 1958-59

Bull	No. of Cows Inseminated	No. of Non-Returns in 60-90 Days	Conception Rate
			per cent.
A	371	205	55.3
B	352	208	59.1
C	406	250	61.6
D	351	234	66.7
Total	1,480	897	60.6

TABLE 4

OVERALL FERTILITY LEVELS (CONCEPTION RATES)

Year	Per Cent.
1955	62
1956	64
1957	52
1958	60

The total insemination data have been considered in order to assess the significance of semen storage quality (Table 5).

TABLE 5

SEMEN STORAGE (CONCEPTION RATES PER CENT.)

Bull	2 Days	3 Days	4 Days	Total
A	63.9	52.2	45.5	56.1
B	64.3	53.7	46.9	56.7
C	67.3	60.2	47.1	61.9
D	68.7	58.3	70.8	64.6
Total	66.2	56.1	52.2	59.8

It is of especial interest to compare the results obtained at Nambour, where semen is not available until the day following collection (i.e. two days old), with those obtained on the Atherton Tableland, where semen is available for use on the day of collection. At Nambour in the season just concluded, 57.1 per cent. of all inseminations were performed with semen older than 48 hours. The fertility levels at Atherton are a preliminary estimate based on approximately the first one thousand inseminations (Table 6).

TABLE 6

AGE OF SEMEN AND FERTILITY LEVEL

District	Semen Age				
	1 Day	2 Days	3 Days	4 Days	Overall
Atherton	74	68	57	..	69
Nambour	..	66	56	52	60

A total of 224 heifers was inseminated during the season, including 102 heifers from the 1957 drop. It is known that a number of heifers were also put to natural service. The present indications are that a high degree of retarded puberty was operating in the 1958 season, as was reported for the 1957 season.

A.I.S. Breed.—The first season of breeding in the Nanango-Kingaroy area commenced on Sept. 23 and extended until Jan. 19. There were 48 dairymen participating in the programme. The number of inseminations performed and fertility data are classified in Table 7.

TABLE 7
INSEMINATION DATA FOR A.I.S. COWS

Insemination	No. of Cows Inseminated	No. of Non-Returns in 60-90 Days	Conception Rate
First	1,208	508	per cent. 42.1
Second	571	282	49.4
Third	221	123	55.7
Fourth and more	36	19	..
Total	2,036	932	45.8

The fertility results are lower than had been expected and lower than those achieved in other areas where artificial breeding has been practised in the State. Certain factors contributing to this situation have been determined. For instance, the first insemination fertility rates of the five bulls used varied from 51.0 to 6.1 per cent. The poor fertility performance of one bull (6.1 per cent.) became apparent by Nov. 6 and the use of his semen was suspended on that date. The replacement bull did not perform substantially better. The semen storage results for all inseminations with semen from the other three bulls are presented in Table 8. The results are based on 1,553 inseminations.

TABLE 8
SEMEN STORAGE (CONCEPTION RATES PER CENT.)

Bull	2 Days	3 Days	4 Days	Total
Bull A	57.5	46.5	45.9	51.7
Bull B	55.6	51.4	36.5	51.7
Bull C	56.0	57.7	40.3	53.1
Total	56.4	52.3	41.2	52.2

Some 54.7 per cent. of the total inseminations was with semen aged 48 hours or more. The semen storage quality is within acceptable limits and the bull fertility may be regarded as uniform within the three animals considered. The unavailability of one-day-old semen (i.e. available for use on the day of collection) automatically imposes a rather low limit to the fertility results which might otherwise be expected.

There is some evidence to suggest that bull fertility tends to improve as the season progresses. This is revealed from an analysis of the fertility data in respect of semen batches. One of the several factors that are involved may be bull growth. This factor will be reviewed again next season.

Breeding Survey and Infertility Investigations

Investigations in reproductive behaviour were supported by funds from the Commonwealth Dairy Industry Extension Grant. There are 150 dairymen actually participating in the survey by making available breeding performance records of their herds. They have continued to maintain a high standard in their compilations of records and their interest in the progress of the work is commendable.

Coding of the data for the three years 1953, 1954 and 1955 is now complete, while the punching of these data onto specially designed cards has been completed by the Bureau of Census and Statistics for two of the years and sorting and tabulation is proceeding satisfactorily.

Detailed analyses for the two completed years have been made the subject matter of an article to be published in the *Queensland Agricultural Journal*. The salient features to emerge from this analysis are briefly referred to below.

The analysis covered 10,177 cows in 127 herds for 1953 and 1954. Of these, 6 per cent. were sold or died before being mated. Following service a further 9 per cent. were sold or died in calf and 3 per cent. were not in calf, a total wastage of 18 per cent. In the ensuing reproductive cycle of the 82 per cent. retained, 5.3 per cent. aborted and 29.8 per cent. required periods of over 13 months in which to calve again. Delays in conception occurred in 47.5 per cent. of the wastage cows.

Delays in mating associated with management practices accounted for 6.5 per cent. of the delays in conception in the herds surveyed, 40 per cent. of which practised hand mating, 40 per cent. paddock mating and 20 per cent. controlled paddock mating.

The two main reasons involving infertility disorders for prolonged intervals between calvings in retained cows and for delays in conception in wastage cows were:—

	Retained (%)	Wastage (%)
Anoestrus	32.5	26.0
Service Return	34.5	57.1

Service return was the most important manifestation of infertility and was almost invariably associated with infectious diseases of reproduction. Failure to conceive after three or more services was particularly important in cull cows.

Conception rate (C.R.) at first service and the number of services per conception (S/C) are used to indicate breeding performance with regard to service return. The average figures for the seven areas surveyed and for the State are given in Table 9.

TABLE 9
CONCEPTION RATE AND SERVICES PER CONCEPTION IN QUEENSLAND

Area	1953		1954	
	C.R.	S/C	C.R.	S/C
	per cent.		per cent.	
Atherton Tableland	52	2.1	43	2.6
Central Coast	51	2.2	53	2.1
Burnett	61	1.6	67	1.5
South Burnett	58	1.9	62	1.6
Darling Downs	56	1.9	66	1.2
Coastal Moreton	56	1.9	59	1.9
West Moreton	67	1.6	60	1.7
Queensland	58	1.9	59	1.8

BEEF CATTLE INVESTIGATIONS

"Brian Pastures" Research Station

At this Station, situated in the Central Burnett, continuous records of the liveweight performance of a herd of approximately 700 beef cattle have now been collected over a period of approximately five years. In addition, trials on various aspects of beef production and pasture management are being conducted in co-operation with the Agriculture Branch of the Department.

The regular pattern of liveweight changes in cattle, with loss of weight in the winter, has been referred to in previous annual reports. Although the extent of the liveweight losses and gains in the various seasons of the year varies according to seasonal conditions, the general trend of liveweight changes has been consistent both in years of high rainfall and in drought years.

The data obtained on liveweight changes of cattle at this Station have given a fairly clear picture of the pattern of growth rate of steers from birth to three years, the age at which most of the male cattle are turned off for slaughter. Some striking aspects of the data are shown in Tables 10-12. The major features are:—

(1) In all years cattle lose weight in the period from mid-May to the end of August.

(2) Following birth, in the period mid-October to mid-December, calves on their dams make good gains (of the order of 1.5-1.6 lb. per day) until May. Calves remain on their dam in most years until August, but make much poorer gains in the period May to August.

(3) Weaning is usually carried out in August, and in the period from August to the following April weaner steers make much less liveweight gain than older male cattle. In 1955-56, yearlings gained 129 lb. more, and in 1956-57, 178 lb. more, than weaner cattle in this period.

(4) The overall gains made by cattle from the age of six months to 18 months (i.e. from the May following birth to the subsequent May) are much less than the gains made at other stages of their growth.

When feed of good quality is available, cattle up to the age of 18 months are capable of making liveweight gains comparable with older animals and they can do this more efficiently in terms of feed required per

pound of gain. For these reasons the adoption of measures to provide adequate feed for cattle in this period of their growth is likely to lead to marked increases in overall efficiency of beef production.

Production Performance Records.—Data on 502 calvings by 244 cows and subsequent growth of calves through the years 1954 to 1957 have been analysed statistically. Estimates of repeatability of performance of breeding cows and of the relationship between the following variates have been made:—

- (1) Weight of the dam in the May previous to calving.
- (2) Birth weight.
- (3) Weaning age of calf (as a measure of time of calving).
- (4) Daily gain in weight of calf from birth to 180 days.
- (5) Daily gain in weight from weaning to yearling age (approximately 18 months of age).
- (6) Yearling weight (i.e. weight at approximately 18 months of age).

Repeatability of a cow's performance is the correlation between her performance in one year and her performance in any subsequent year. The following are the estimates of repeatability of the variates considered:—

	Repeatability	95 Per Cent. Confidence Limits
Birthweight of calf	0.25	0.12 to 0.36
Weight of dam	0.86	0.83 to 0.89
Weaning age	0.13	0.00 to 0.25
Gain A	0.63	0.55 to 0.71
Gain B	0.24	0.06 to 0.40
Yearling weight	0.33	0.16 to 0.48

Repeatability is measured on a scale from 0 to 1. A repeatability of 0 would indicate that none of the variation from the average shown by a cow in one year was shown in the next year. A repeatability of 1 would indicate that a cow showed the same variation from average in every year. No similar data for comparison purposes are available on repeatability of traits in beef cattle under other Australian conditions. However, these estimates are similar to those reported at a number of centres in the U.S.A.

Male calves were found to have birthweights heavier than female calves and these differences were statistically significant. The difference between male and female calves in gain to 180 days, gain to yearling age and yearling weight were not statistically significant.

The rate of gain from birth to weaning was significantly less for calves or first-calf heifers than for adult

cows. Differences between first-calf heifers and older cows in birth weight, in gain from weaning to yearling and in yearling weight were not statistically significant.

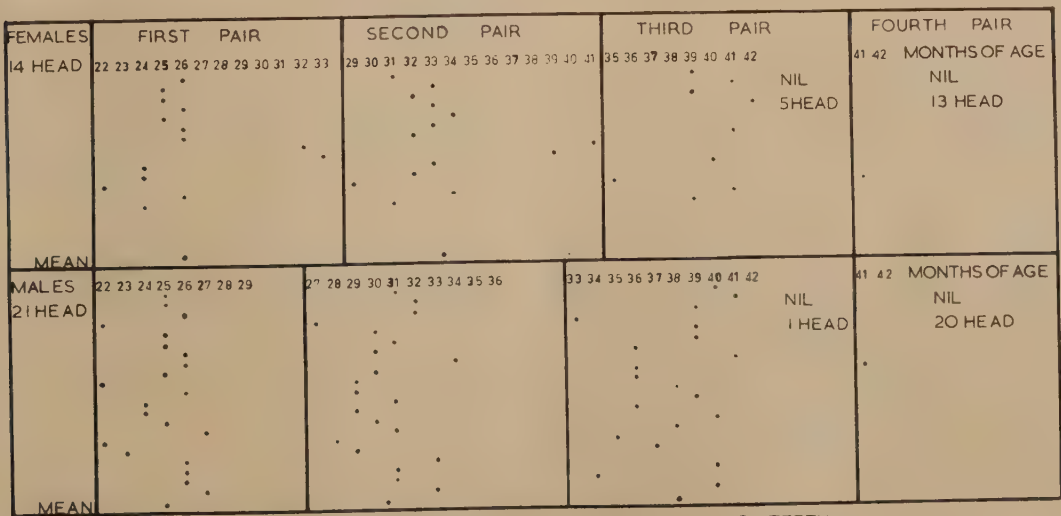
Dentition Studies.—Observations have been carried out at "Brian Pastures" on the age at which permanent incisor teeth of both male and female cattle erupt. Examination of the teeth is the method generally used for estimating the age of beef cattle. This study was carried out to provide data on the ages at which eruption of various teeth occurs and on the variability between animals in age of eruption. Similar studies have been made in other countries, but as it is feasible that environmental conditions could affect time of eruption of teeth, observations under Queensland conditions were considered desirable.

The observations were made on 35 animals—21 males and 14 females—from birth to 3½ years of age. The ages at which eruption of the various pairs of incisor teeth occurred in animals of both sexes is depicted in Plate 29. Within both sex groups, 70 per cent. or more of the animals erupted the first pair of incisors at ages from 24 to 26 months. The spread of eruption time of the second and third pairs of incisor teeth was greater than for the first pair. The result of the observations do not differ greatly from those reported from similar observations in South Africa and Great Britain. The data indicate that examination of teeth of cattle can provide a fairly reliable estimate of the average age of large groups of cattle but that it could lead to fairly large errors in estimating the age of individual animals.

Time-of-Calving Trial.—In the "Brian Pastures" herd the time of calving of the main breeding herd is restricted to a period of approximately 60 days each year from mid-October to mid-December. Calving at this period is the usual practice in beef herds in south-eastern Queensland in which time of calving is controlled. However, there are at present very few data available to indicate what is the optimum time at which to calve cows in this area. With the marked and fairly consistent variation which occurs in the availability and quality of pasture at different seasons of the year in Queensland, it can be expected that time of calving would exert a marked effect on growth rate of calves.

TABLE 10
LIVEWEIGHT PERFORMANCE OF TWO-YEAR-OLD STEERS,
1955-57, "BRIAN PASTURES" RESEARCH STATION,
GAYNDAH

Year	Liveweight Change in Lb.			
	Dec.-April	April-Aug.	Aug.-Dec.	Dec.-Dec.
1955	+151.3	-12.8	+169.3	+307.8
1956	+139.0	-47.9	+143.8	+234.9
1957	+138.6	-108.7	+88.7	+118.6



AGE OF ANIMALS AT ERUPTION OF PERMANENT INCISOR TEETH

Plate 29.—Diagram Showing Eruption of Teeth in Grade Herefords at
"Brian Pastures".

During the year a trial was commenced at "Brian Pastures" to study the performance of groups of breeders calving at different times of the year. One group is mated to calve from mid-July to mid-September, the second group from mid-October to mid-December and

the third group from mid-January to mid-March. The trial was commenced with virgin heifers and each group will be mated to calve at the same time in consecutive years. It is proposed that the trial continue for at least five years.

TABLE 11
LIVEWEIGHT PERFORMANCE OF WEANER AND YEARLING STEERS, "BRIAN PASTURES" RESEARCH STATION, GAYNDAH

Liveweight Change in Lb.					
	Aug. 1955- Dec. 1955	Dec. 1955- April 1956	April 1956- Aug. 1956	Aug. 1956- Dec. 1956	Aug. 1955- Dec. 1956
Weaners*	+50.0	+89.5	-31.5	+152.3	+260.3
Yearlings*	+157.0	+111.6	-47.9	+144.0	+314.7
	Aug. 1956- Dec. 1956	Dec. 1956- April 1957	April 1957- Aug. 1957	Aug. 1957- Dec. 1957	Aug. 1956- Dec. 1957
Weaners.. ..	+43.4	+69.7	-71.8	+110.6	+151.9
Yearlings	+152.3	+138.6	-107.1	+87.1	+270.9

* Weaner steers were aged 8-10 months and yearlings steers 12 months older at the commencement of observations.

TABLE 12
GROWTH RATE OF MALE CALVES FROM BIRTH TO WEANING, "BRIAN PASTURES" RESEARCH STATION, GAYNDAH

Liveweight at Monthly Weighings in Lb.										
Year	No. of Calves	Birth- weight (Oct.- Dec.)	Jan.	Feb.	Mar.	April	May	June	July	Aug.
1954-55	50	75	167	209	261	310	359	368	371	373
1955-56	68	74	200	246	303	335	372	390	390	379
1956-57	80	76	203	244	277	305	324	340	332	weaned
1957-58	64	68	167	214	278	330	374	388	396	402

Economics of Crop Fattening of Beef Cattle

During 1958 an investigation was undertaken in co-operation with the Commonwealth Bureau of Agricultural Economics into the economics of crop fattening of beef cattle. The investigations were undertaken with the assistance of 18 beef cattle producers in the Darling Downs, Burnett and Central Coastal districts, who made available data on the costs and returns involved in crop fattening on their properties.

Because of the highly seasonal nature of pasture productivity in the summer rainfall environment of Queensland, the use of winter grazing crops for fattening cattle has major importance, particularly as a means of turning off cattle in late winter and spring and of turning off prime young cattle of the type most favoured for the local meat trade and for export as chilled beef.

In these investigations a record was kept on each property of the direct costs involved in growing the crops, such as labour, cost of fuel, repairs to machinery, etc. Allowance was made for depreciation and interest on capital invested in machinery and improvements. To estimate gross costs, an estimate of the return which could be obtained from the area cropped if it had remained as pasture was added to the above costs.

To assess returns from the crop-fattening enterprise, stock were weighed when introduced to crop and when turned off. Where available, prices of cattle at the beginning of the fattening period and when turned off were obtained. In some cases the carcass weights of the cattle were obtained when they were slaughtered. From this information it was possible to partition the income from crop fattening into (a) the value of the meat produced while on crop, and (b) income due to appreciation in value of beef during the period cattle are on crop.

The latter portion is an important consideration in assessing the profitability of crop fattening. The price per 100 lb. carcass weight of cattle for slaughter usually appreciates to a marked extent during the period April to October each year. This can be attributed to the lower productivity of pasture in this period, with consequent shortage of supply of prime cattle.

All of the properties covered by the investigation in 1958 showed a net profit from crop fattening. The total costs of production of crop per acre varied from £2 12s. 6d. to £5 7s. 6d. and the returns from cattle grazing crop varied from £7 10s. 9d. to £35 8s. 6d. per acre. After deducting the estimate of returns obtainable from pasture and adding net returns from grain on those properties where the crops were subsequently harvested, the total net incomes from crop varied from £2 17s. to £30 8s. per acre.

In considering the results for 1958 it should be recognised that the year was a favourable one on most properties in relation to seasonal conditions and marketing conditions. Widespread rains in June ensured good crops and the appreciation in market value of cattle from the commencement of the crop-fattening season until the end of the season was much greater than usual.

Observations are being continued on this project during 1959 on a range of properties covering a larger area than the 1958 sample.

Milk Production of Beef Cows

Most of the growth rate studies reported previously in Queensland were concerned with growth rate of steers in the period between weaning and time of turn-off for slaughter. Growth rate in the pre-weaning period has received less attention. This phase of growth is influenced primarily by the milk production of the dam, which, in turn, is influenced by both genetic and environ-

mental factors. To provide some basic data on this aspect of beef production, a trial was initiated in November 1956 to obtain estimates of the milk production of a group of beef cows and to record the growth rate of their calves.

The property on which the trial was conducted comprises country comparable with large areas of grazing country in central-coastal Queensland with pastures in which bunch spear grass (*Heteropogon contortus*), white spear grass (species of *Aristida*) and blue grasses (species of *Dichanthium* and *Bothriochloa*) are the predominant species.

Estimates of the milk production of individual cows were made over 24-hour periods at monthly intervals. The estimates were made by recording weights of calves immediately before and immediately after suckling in the morning and afternoon of the 24-hour period. The calves were penned overnight before suckling and between morning and afternoon suckling periods.

In 1956-57, observations were made on 19 cows and their calves from November 1956 until September 1957. In 1957-58, observations were made on 11 2- and 3-year-old cows calving in August and early September and their calves, and on 12 mature cows calving in October and early November and their calves. In each group, milk production reached a peak of approximately one gallon per cow per day in the midsummer period and declined thereafter. In all groups milk production declined to approximately 2-3 lb. by May. The variation in milk production was reflected in the changes in body weight of the calves. The calves made gains of the order of 1½ lb. liveweight per day during midsummer but their rate of gain declined sharply after April.

In the 1957-58 season the group of 2- and 3-year-old cows calving early did not reach as high a milk production as the group of mature cows calving later, but their effective lactation period was longer. The calves of the early-calved group were 80 lb. heavier in April than the later-calved group and as milk production of both groups declined thereafter they maintained a liveweight advantage.

The results indicate that time of calving and plane of nutrition can exert a marked effect on milk production of cows and on the growth rate of their calves.

Supplementary Feeding of Beef Cattle

The seasonal nature of growth rate of cattle on unimproved pastures, with loss of weight in winter, has been referred to in the section of this report dealing with the "Brian Pastures" Research Station. The importance of this factor in reducing the rate of turn-off of cattle and hence the overall production of beef cannot be

over-emphasised. In more favoured areas the use of improved pastures or grazing crops offers the most satisfactory solution to the problem. However, there are many beef-producing areas in Queensland where these methods are not, at present, applicable. For such areas the use of supplements during periods when pastures are inadequate may offer a solution to the problem.

The value of small amounts of supplements—particularly those of high protein content—in improving performance of cattle and sheep hand-fed on low-quality roughage has been demonstrated in a number of experiments, principally by C.S.I.R.O. and the Husbandry Research Branch of this Department. There is, as yet, no conclusive evidence on the effect of similar supplements for cattle grazing pastures of low quality such as occur regularly over many areas of Queensland each year.

In 1958 a number of trials were conducted in Central Queensland on supplementary feeding of beef cattle. In the trials supplementary feeding of yearling steers was carried out with the following feeds:—

Property No. 1:

Group A (20 head): 2 lb. lucerne hay per head per day fed twice weekly.

Group B (20 head): 2 lb. native pasture hay + 1 oz. urea + 1 lb. molasses per head per day fed twice weekly.

Group C (20 head): No supplement.

Property No. 2:

Group A (15 head): 3 lb. cracked sorghum grain (+ 1 per cent. limestone) per head per day fed twice weekly.

Group B (15 head): No supplement.

Property No. 3:

Group A (20 head): 5 lb. native pasture hay + 1½ oz. urea + ½ lb. molasses per head per day fed twice weekly.

Group B (20 head): No supplement.

In both trials in which native pasture hay with urea and molasses was used, the groups receiving this supplement did not show any appreciable advantage in liveweight gain over unsupplemented animals. The groups receiving either grain sorghum or lucerne hay both gained approximately 50 lb. more weight than unsupplemented groups during the feeding period extending over five months of late winter and spring. However, when supplementary feeding ceased the unsupplemented groups in both cases made substantially greater gains than the previously supplemented groups during the summer. In consequence, the final advantage in liveweight of the two supplemented groups was only fairly small.

PIG AND POULTRY BRANCH

PIG SECTION

The improvement in conditions generally in the industry, which started about the middle of 1958, continued throughout the year under review. This improvement is reflected in an increase of over 50,000 in the number of pigs slaughtered.

FEED SUPPLIES

During 1957-58 dairy by-products for pig feeding, green feed, fodder crops and grain were in short supply, with grain expensive also. The favourable weather conditions in 1958-59 ensured ample supplies of feed-stuffs at prices economic for pig feeding.

Dairy by-products were adequate for most of the year, except in North Queensland, where unfavourable weather and the increased demand for milk for human consumption reduced separated milk supplies considerably.

Green feed supplies were generally adequate. Kikuyu grass has been established on many farms for grazing, and areas of lucerne for green feed or hay are being established. Irrigation was used on many farms during the year to provide green feed.

Grains were available in far greater variety and quantity during the year, and at much lower prices than for some few years. Wheat, barley, grain sorghum, oats, maize, millet and canary seed were all readily

available. Because of the high price, little wheat was used, but large quantities of sorghum have been fed to pigs in the central and southern areas. Appreciable quantities of maize were used in the southern areas, where maize is normally grown as pig feed. Barley was available in quantity at reasonable prices, and many farmers stored a quantity for winter and spring feeding.

Mill offals were not used to the same extent this year, owing to the quantity of grain available at cheaper rates. The supply of protein concentrates has generally been adequate. The better season for dairying has enabled production of more separated milk than in the previous year, thus relieving the demand for meatmeal. The increased slaughterings of cattle for export also meant greater meat-and-bone meal production. Livermeal, peanut meal and dried milk were available in intermittent supply. Demand for these three meals is increasing as farmers tend to develop creep feeding of litters.

DISEASE

No major disease outbreaks of an epidemic nature were reported.

In North Queensland, several outbreaks of suspected haemolytic streptococcal infection, in piglets were

reported, and two cases confirmed by bacteriological check. Several outbreaks of necrotic enteritis were also reported. In central Queensland, outbreaks of pneumonia and paratyphoid were noted, and sarcoptic mange was prevalent during the spring months. Cases of poisoning by thornapple and prickly poppy seeds were investigated, and a number of pigs died in the Don River area due to grazing on a wilted ratoon crop of sorghum.

Photosensitisation cases were numerous in southern Queensland during January to March. Salmonella infections and various forms of pneumonia were reported from this area. Heaviest losses occur on the Darling Downs during or after cold wet weather, on farms where the housing is poor.

Baby pig scours were reported from all these areas, as well as sarcoptic mange, post-parturient fever and posterior paralysis. Leptospirosis infections caused some concern in some piggeries and interfered with breeding programmes. Many of these outbreaks were probably due to the introduction of pigs from saleyards or the purchase of breeding stock. Use of a vaccine appears to be of use in prevention.

A few cases of brucellosis were reported from farm piggeries. The official brucellosis-tested herd scheme continued to operate and over 90 per cent. of the stud breeders participated. There are at present 95 herds in the scheme and one herd is ready to be admitted. The owners of six herds withdrew during the year.

TABLE I
RESULTS OF PALATABILITY TRIALS

No. of Pigs	Ration	Per- centage of Total Feed Consumed	Average Daily Con- sumption per Pig (lb.)	No. of Pigs	Ration	Per- centage of Total Feed Consumed	Average Daily Con- sumption per Pig (lb.)
Trial 1							
9	1 Crushed Barley	33	} 6·8	6	1 Mixture— (83% crushed sorghum, 17% meatmeal)	52	} 6·0
	2 Pellets (55% meatmeal, 20% milk powder, 10% liver meal, 10% peanut meal, 5% lucerne-meal)	6·3			2 Mixture— (83% crushed maize, 17% meatmeal)	20	
	3 Crushed Wheat	33			3 Mixture— (41·5% crushed sorghum, 41·5% crushed maize, 17% meatmeal)	28	
	4 Meat-and-bone meal (55% protein)	5			For a fortnight before the commencement of the trial, the group was fed a mixture of 5% milk powder, 17% meatmeal and 78% crushed sorghum.		
	5 Mixture— (40% crushed barley, 40% crushed wheat, 10% pellets, 10% meatmeal) ..	22·7					
Trial 2							
12	1 Meatmeal	10·8	} 4·2	9	1 Mixture— (83% crushed sorghum, 17% meatmeal)	43	} 4·2
	2 Crushed sorghum	84·6			2 Mixture— (83% crushed maize, 17% meatmeal)	29	
	3 Lucerne hay	4·6			3 Mixture— (41·5% crushed sorghum, 41·5% crushed maize, 17% meatmeal)	28	
Trial 3							
18	1 Basal ration— (70% maize-meal, 5% lucerne-meal, 5% pollard, 20% meatmeal)	19	} 6·8	For the fortnight before the trial, the group was fed a mixture of 83% crushed sorghum and 17% meatmeal.			
	2 B.R. + 1% molasses	15					
	3 B.R. + 3% molasses	11					
	4 B.R. + 6% molasses	13					
	5 B.R. + 12% molasses	17					
	6 B.R. + 20% molasses	25					
Trial 4							
7	1 Mixture— (83% crushed sorghum, 17% meatmeal)	36	} 4·8	15	1 Basal Ration— (78% crushed grain, 17% meatmeal, 5% buttermilk powder)	7·7	} 5·9
	2 Mixture— (83% crushed maize, 17% meatmeal)	33			2 B.R. + 3% sugar	21·7	
	3 Mixture— (41·5% crushed sorghum, 41·5% crushed maize, 17% meatmeal)	31			3 B.R. + 7% sugar	24·2	
No sorghum or maize was fed to this group before the trial.					4 B.R. + 10% sugar	35·8	
					5 B.R. + 5% buttermilk pow- der	10·6	
Trial 5							
9	1 Mixture— (83% crushed sorghum, 17% meatmeal)	37	} 4·8	13	1 Basal Ration— (78% crushed grain, 17% meatmeal, 5% buttermilk powder)	4·5	} 5·3
	2 Mixture— (83% crushed maize, 17% meatmeal)	35			2 B.R. + 10% sugar	61·2	
	3 Mixture— (41·5% crushed sorghum, 41·5% crushed maize, 17% meatmeal)	28			3 B.R. + 3% whey powder ..	9·2	
For a fortnight before the commencement of the trial, the group was fed 83% crushed maize and 17% meatmeal.					4 B.R. + 7% whey powder ..	13·5	
					5 B.R. + 10% whey powder ..	11·6	

REGIONAL EXPERIMENT STATIONS

As is now usual, the piggeries on these Stations were used mainly for investigations of pig husbandry problems and in particular to study palatability of various foodstuffs.

When rationing pigs there are two major considerations, viz. the protein and the energy content of the ration. Carbohydrate-rich foods are generally cheaper than the protein-rich foods taking either the weight unit or the energy unit as a basis for comparison. Thus for economical pig production, the maximum utilization of the former type of foodstuff is desirable. Consequently, the aim in economical pig production is the use of the minimum amount of the more expensive of the protein-rich food.

Very few protein-rich feeds with high biological value are palatable enough to be consumed in the required amount when fed separately and so farmers often mix the protein-rich foods into a ration with the more palatable energy-rich foodstuffs to increase the intake of protein. The self-feeding of a balanced ration is, however, not necessarily the most economical programme, because these theoretically correct rations sometimes fail to give satisfactory growth on farms. There are many reasons for the failure, but one of the more common causes, where free-choice feeding is practised, is the palatability of the foodstuffs in the ration. Because of this, knowledge of the comparative palatability of foodstuffs suitable for pig feeding may have a significant practical application in the future.

The following outline of results obtained from trials carried out shows the importance of palatability in relation to the food consumption of pigs.

All the pigs in any one trial slept in a communal shed and the foodstuffs being compared were made available in 44 gal. drum self-feeders. These feeders were arranged so that no bias was created for any particular drum. *Ad lib.* group feeding was practised and so only group consumption figures are known. Drinking water was made available from self-waterers.

The assumption that the more palatable food would be consumed in the greatest quantity is held to be valid and the group consumption (given as pounds of meal eaten) is used as the criterion of palatability. Nevertheless, it is realized that the results obtained must be accepted as indications only and will require checking.

A summary of the results is given in Table 1.

It is quite obvious from the table that the protein-rich foods are less palatable than cereals. With trials 1 and 2 the crushed grain is the most palatable foodstuff. When a mixture of grain and protein-rich food was fed, the palatability of this balanced ration was intermediate between the limits. This trial is thought to exemplify the pattern expected and so it was not repeated.

With trials 3, 8 and 9 a balanced ration was fed straight and plus a number of supplements known as palatability stimulants. Each trial shows one supplement to be clearly the most palatable. Trials 4, 5, 6 and 7 show the palatabilities of maize and sorghum to be similar but reveal a tendency on the part of the pigs taking part to prefer sorghum.

The average daily consumption per pig varies from trial to trial. In trials 4 to 7, where the same rations were fed, the variation (as pounds meal consumed) is 1.8. This shows the complexity of the problem and serves to indicate the wide range of results which can be expected on farms. In each trial, every encouragement was given to the pigs to eat and the trial animals were not in any way hampered by disease, etc., yet under good conditions this wide range of intake occurred. Generally, where supplements were added to a basal ration consumption was increased.

The quantity of grain available for stock feeding is increasing. A simple method of using grains is the *ad lib.* feeding programme which makes use of the minimum quantity of the expensive protein-rich foods. Any factors influencing the success of such feeding programmes are of major importance and the results of the trials show the complexity of only one of the influences. Because of this palatability problem, generalised satisfactory recommendations for efficient, economical self-feeding of pigs under a wide range of farming conditions

are not at present possible. Studies to elucidate a sound generalised recommendation are, however, being undertaken.

In addition, basic information regarding growth and sow reproductive performance is being collected. By subjecting growing/fattening pigs to various nutritional conditions, and recording the growth performance under the given conditions, indications as to the suitability of various feeding regimens are being obtained.

From such methods, information regarding the suitability of canary seed, white French millet and Korean millet as pig feeds has been obtained. Rations for creep feeding and early weaning have been developed and these have been found to give very satisfactory results under a wide range of farming conditions.

Sow and litter accommodation and management have been intensively studied and as a result the 8-weeks weight of the litters on these Stations is increasing and the present ceiling is an average weight of 60 lb. for the litter. Sow feeding stalls, creep feeders, and creep waterers were designed, modified and tested till the designs were proved. These designs have now been made available to the agricultural community.

PIG TESTING STATION

In August 1958 the newly erected Pig Progeny Testing Station situated on the Department's Animal Research Farm, Sherwood Road, Rocklea, was taken over from the Public Works Department and brought into operation. The Station is patterned on the latest Danish design but certain additions, modifications and improvements had to be incorporated to meet specific Queensland climatic and labour conditions.

Before testing of stud stock could be commenced, it was necessary to conduct a thorough proving trial of the Station under actual working conditions. This was in order to establish a working routine and to find and correct any weakness in the planning. Consequently, 60 pigs were brought in from the Regional Experiment Stations and accommodated in the pens.

Because no liquid milk is fed to the pigs, each pen is equipped with an automatic self-watering float-type bowl and it was found necessary to design and install an overflow pipe in each. It was also found necessary to feed a pint of water with each pound of feed to prevent wastage of food, as pigs have a natural inclination to root through the food and push it out of the trough. Mixing water with the food till it has a consistency of thin porridge overcomes this habit.

The manure carrier and weighbridge running on a monorail worked according to plan.

The air-conditioning plant has proved its worth under varying climatic conditions by keeping the humidity and temperature at a pre-determined constant level, eliminating any necessity for the pigs to draw on the ration to adjust their body heat to any rise or fall in temperature and humidity. It also ensures that all pigs tested at the Station come under equal conditions, no matter what the climatic conditions may be under which they have been reared. By eliminating all outside influences in this manner, the true food conversion of a pig can be determined.

To prevent deterioration and wastage of the various grains used and to ensure that a wholesome and properly mixed ration is always on hand with a minimum of labour cost, a modern storage and mixing plant has been installed. The rations consist of wheat, sorghum, mealmeal, lucerne meal and a mineral mixture fortified with vitamins A, D, and B₂. Three rations are used, based on 17, 15, and 13 per cent. crude protein respectively. Each time a new consignment of either one of the foodstuffs is brought in, an average sample is taken and analysed at the Animal Research Institute. On this analysis the ration is worked out and the machines adjusted accordingly. By this method the level of protein in the respective rations can be kept constant so that any pig being tested receives the same treatment no matter when it arrives.

The pigs are fed twice daily—at 8.15 a.m. and 4.20 p.m. The pens are cleaned out daily and washed out and disinfected once a week. All pigs are weighed once a week on the same day and at the same time.

On Mar. 31, 1959, the Station was made available for testing of stud stock. As at June 30, 48 pigs received from chosen applicants were under test.

GENERAL

In addition to progeny testing, a farm litter recording scheme was commenced in January. On the Darling Downs, the results to date have shown breeders that their results with litters could be improved considerably. Already there is a tendency in recording districts for farmers to seek breeding stock from herds with reliable litter records.

All officers have now settled into their districts following transfers in 1958, and know something of the problems of the districts involved.

The appointment of two officers to supervise demonstrations under the Commonwealth Extension Services Grant enabled resumption of work in the Mundubbera and Moreton areas. These demonstrations are being developed, and are now subject to regular visits again.

A feature of the year has been a movement by the pig industry away from dependence on the dairying industry.

Farmers tend now to provide a better standard of housing for their pigs, but much work remains before the general standard of piggery accommodation is satisfactory. The moulds for circular pens were used in the various districts. Further research is necessary into the design of sheds which will be cool during the summer months, yet readily adapted to provide warmth in winter. Feeding stalls for sows are becoming popular in some areas.

The Landrace breed is becoming established in the State. Two studs in the Moreton area have breeding stock, and there are several animals in other districts.

Branch Officers participated in field days, lectures, slide and film evenings during the year. Lectures were given by a senior Branch Officer to two schools for New Australians at the Queensland Agricultural High School and College. The officer from Toowoomba lectured at a dairy farmers' school, and the Warwick district officer attended a Bankers' Regional Conference in Toowoomba in an advisory capacity.

The cured baconer carcass competitions at country shows appear to be more popular when the judging is done at the show, where everyone can watch judging.

POULTRY SECTION

A considerable number in the industry have taken the opportunity to increase their flock size. It is rather significant that this trend has taken place in the grain-growing areas, where the advantages of cheap grain more than outweigh the disadvantage of longer distance from egg markets. In the Metropolitan and North Coast areas, there is renewed interest in the laying cage system of poultry farming. Some farmers who have for many years farmed on the intensive or semi-intensive (house-and-yard) systems have spent considerable sums of money converting them to laying-cage plants.

The poultry industry in Southern Queensland has recovered remarkably quickly from the decline of 1957-58. Recorded production for 1958-59 was 9 per cent. higher than in the previous year.

The use of early morning lighting in laying sheds during autumn and winter is now an accepted practice in southern Queensland. It is estimated that at least 40 per cent. of commercial farms now have "lights" installed.

Production in Central Queensland continued to increase during the year under review by some 16 per cent. over the previous year. The ready availability of cheap sorghum and maize in the main production areas of Wowan and Mount Larcom has been welcomed by producers.

Production in North Queensland remains at or near the level for 1957-58. Some increase in the size of two flocks has been noted in the Townsville area. Producers in Cairns and Townsville, while benefiting from a higher egg price, have had to pay substantial feed costs. Practically all mix their own mash and used mill offals from southern Queensland extensively. The successful work at the Kairi Regional Experimental Station on fibre levels with layers showed the advantages of the low-fibre type of ration based mainly on ground grain and this has influenced a number of them to increase the amount of grain well above that previously used at the expense of mill offals in their rations. As local grain could be purchased at £10 a ton cheaper than mill offals, a real saving has been effected.

TABLE POULTRY PRODUCTION

The rapid development of a broiler industry as a distinct phase of poultry production has been one of the striking features of the year under review. Broiler production in the Metropolitan and Gold Coast areas rose by over 50 per cent. Similar trends were noted elsewhere. In Maryborough, broiler production has become a very important industry. Established by a large meat-exporting company, the industry is based on the American pattern of integration between con-

tract grower and parent company. The grower provides the facilities and labour, and the company provides the chickens and feed and a supervisory service. The company guarantees a contract price and deducts chick and food costs from the individual gross return. It is expected that production from this centre may soon reach the target of a quarter of a million per year. Efficiency of operation is very good and food conversion rates of just over 3 lb. of food per pound gain in weight are considered to be amongst the best in Australia.

The main limiting factor to even better conversion is the class of bird available, for there is no true meat-type bird available in Queensland, broiler growers being dependent on commercial chickens used for egg production. During the period October to April, when few hatcheries are operating, broiler growers have to purchase both cockerel and pullet day-old chickens. The hot climatic conditions and the slower growth of pullets reduce the margin of profit during this period.

Broiler production has also increased in other coastal centres, notably in Cairns, where one producer who is also a large commercial farmer has built a modern abattoir with snap-freezing and vacuum packaging facilities to handle his output.

However, the very rapid expansion in the broiler industry, particularly in southern Queensland, has temporarily exceeded the demand, with the result that prices for this class of poultry have receded. The number of hens available for slaughter has fallen short of demand with the result that towards the end of the year under review they were sometimes selling at more than cockerel price. Doubtless the shortage of hens is due mainly to the fact that farmers are loath to sell off laying birds while high egg prices are ruling. The average price for hens for 1958-59 would have been nearly double that paid during 1957-58.

Table 1 sets out the total number of poultry slaughtered in the Brisbane—Gold Coast area.

TABLE 1
POULTRY SLAUGHTERINGS AT ABATTOIRS IN BRISBANE—
GOLD COAST AREA, 1954-55 TO 1958-59

Year	Cockerels (Broilers)	Hens	Total slaughtered (including ducks, turkeys, &c.)
1954-55 ..	137,118	346,417	604,725
1955-56 ..	316,991	381,561	512,438
1956-57 ..	348,922	400,105	734,952
1957-58 ..	362,713	377,105	779,090
1958-59 ..	552,794	345,992	928,654

DAY-OLD CHICK PRODUCTION

The number of chickens sexed in 1958 was 3,002,024, which was slightly more than in 1957. The production of "unsexed" chickens during the summer months by a few large hatcheries for broiler plants is considerable and is rising. It was expected that 1958 hatchings would not be markedly greater than 1957 because of the adverse economic conditions which obtained until May of last year. However, the number of chickens sexed in 1959 is expected to rise considerably owing to the more optimistic outlook for the industry. There also appears to be an increasing interstate trade in day-old chickens to New South Wales.

REGISTRATION OF STOCK SUPPLIERS

During the year 18 stock suppliers cancelled their registration for the business of hatching chickens for sale, six cancelled for the business of supplying fertile eggs for hatching, and four dealers did not renew their registrations. New registrations were as follows:—nine for the business of hatching chickens for sale, nine for supplying fowl eggs for hatching, and six as poultry dealers. In 1957-58, the total number registered was 193. The number now registered as stock suppliers is 189.

POULTRY ADVISORY BOARD

This Board met on three occasions. The business dealt with included the amount of precept to be levied on Marketing Boards; draft regulations on the proposed marking and grading of eggs; egg quality investigations; the programme of experimental work to be conducted by the Poultry Section; suggestions regarding legislation to amend the Poultry Industry Acts in certain directions to provide for greater Government contribution to the Poultry Industry Fund from Consolidated Revenue; and considerations of ways and means to increase revenue to the Poultry Industry Fund from industry sources.

QUEENSLAND POULTRY IMPROVEMENT PLAN

There are now 13 poultry breeders co-operating with this Section in the Queensland Poultry Improvement Plan. Seven of these breeders have their farms in the Brisbane area, five on the near North Coast and one in the Toowoomba area.

Two breeders are using the full-sister scheme which involves the individual testing and recording of between 700 and 1,000 birds. Pedigree records of all these birds have to be kept for at least two years so that inbreeding can be avoided.

The other 11 breeders use the half-sister scheme which involves the testing of from 10 to 20 families of half-sisters. At least 30 half-sisters from each family are tested and sires are selected on the basis of their half-sisters' performance.

In the first year of the scheme most breeders found difficulty in organising their hatching and accommodation to suit the scheme. However, in the year under review they have found that their first year of experience with the scheme has enabled them to co-ordinate their work. The records kept by these breeders have been of a high standard. It is pleasing to note that hen-housed production averages for the best families of up to 108 eggs per bird have been recorded in a 4½ months' test. It is also very interesting to note that differences of up to 40 eggs per bird have been recorded between the best and the worst families.

RANDOM SAMPLE TESTING

The 1957-58 Random Sample Test for breeders in the Queensland Poultry Improvement Plan concluded early in January 1959, and all entrants in this random sample test were advised of the results.

The results for certain economic factors were used to grant approval on probation to the co-operating breeders in the Queensland Poultry Improvement Plan. Of the 11 breeder entrants, only two met the requirements for this probationary approval.

The average hen-housed production for the 48 weeks' period of the test was 160.83 eggs per bird. Food efficiency in terms of pounds of feed to produce a dozen eggs was 6.04 lb. This is a reasonable commercial figure under present conditions. However, the range of from 4.88 to 7.28 lb. of feed per dozen eggs shows the urgent need for sound breeding programmes in this State.

An average hen-housed mortality of 12.31 per cent. for the laying period was very creditable for an uncultured flock. Again, however, the range of 5 to 22.5 per cent. indicates how susceptible many strains are to disease.

The 1958-59 Random Sample Test commenced at 18 weeks of age on Jan. 14. The average age for first egg was 143.4 days, which compares more than favourably with 153 days for the previous test. The birds in the current trial came into production earlier, reaching 50 per cent. production at 173.1 days, compared with 192 days in 1957-58. Mortality has been light, and the general average production at the present time is ahead of that obtained at a similar time in 1958.

It is anticipated that the overall results will be far better than those obtained in the previous test. It is rather significant to note that five of the breeding flocks which did not come up to expectation in last year's test are well to the fore this year, and that the improved results in the current test reflect the improvement in the records kept by the breeders concerned.

A large intensive shed 108 ft. long and 35 ft. wide was erected at the Random Sample Test site in August 1958. It features a gable roof with a raised ridge-capping to provide ventilation and a central service-way for ease of working. Capable of housing up to 2,000 birds at 18 weeks of age, it has provided ideal conditions for rearing the Random Sample stock under a uniform environment. A third row of laying pens was also completed. Accommodation for 15 breeder entries can now be housed for the 48 weeks' production period of the test. However, it is considered that, if a longer period of testing is required, and there are good reasons why it should be lengthened, urgent thought must be given to the erection of a fourth row of pens.

EXTENSION WORK

The Section has been active in field work. Over 4,000 visits were paid to farms. The number of demonstrations given was 968, which was well above the number for the previous year. As in previous years, fowl pox vaccination and culling demonstrations were most in demand, but with the development of table poultry production, instruction in the technique of chemical caponising was well to the fore.

Mass media were used effectively. Good liaison exists with country newspapers. Radio broadcasts (16) and talks to farmers' associations (24) were also made. The Section prepared five articles for the *Queensland Agricultural Journal* dealing with culling, genetics, food wastage, egg quality, and keeping poultry on the dairy farm.

EGG QUALITY EXTENSION PROGRAMME

Much thought and time have been given to the study of the quality of eggs received at the Egg Marketing Board in Brisbane. It was apparent from observation that the quality of eggs received by the Board during the summer months left much to be desired and that small consignments received from distant centres were often faulty. Investigations showed also that the maintenance of egg quality is not solely a farm problem, although in all fairness it is admitted that an improvement in handling and holding conditions on farms would help very materially in solving the problem. One important factor is the lack of knowledge of the perishable nature of the product by many retailers. Perhaps one of the biggest hurdles in the implementation of an egg quality improvement programme is the fact that many farmers do not realise that they have a problem. A series of colour transparencies on egg quality have been prepared and these have been used to advantage at poultry association meetings. A 16 mm. colour film with sound has been completed on the effect of heat on egg quality and will be used in the coming year as a talking point at producer meetings.

RESEARCH WORK

Fibre Levels and Egg Production

The "low fibre" high-energy type of ration is now being used widely for both broiler and egg production. Two advantages, viz. higher production and lower food consumption, are claimed. The trial at Kairi Regional Experiment Station which was completed in January 1959 confirmed these advantages. Three all-mash laying rations with fibre levels of 3.5, 5.5, and 7.5 per cent. respectively were each fed to groups of 120 pullets. There were six replications within each group.

Table 2 sets out the results of this trial over a period of 52 weeks of lay.

TABLE 2
RESULTS OF FEEDING ALL-MASH RATIONS VARYING IN
FIBRE CONTENT TO LAYERS

	Low Fibre Ration	Medium Fibre Ration	High Fibre Ratin
	Eggs	Eggs	Eggs
Production per bird housed	179.5	175.4	157.8
Production .. per survivor	195.8	191.4	173.7
Total food eaten per bird started ..	lb. 91.0	lb. 96.9	lb. 103.9
Lb. feed/dozen eggs	6.2	6.63	7.9
	Pence	Pence	Pence
*Cost of ration per lb.	3.54	3.30	3.15
*Cost of feed per dozen eggs ..	21.95	21.87	24.85
	Per cent.	Per cent.	Per cent.
Per cent. deaths ..	10	8.3	9.1

* Prices based on ruling prices for foodstuffs at the Kairi Regional Experiment Station.

In this experiment wheatmeal was used extensively. Had it been replaced by sorghum meal it is very likely that the cost per pound of the low fibre ration would have been somewhat less than the high fibre ration based on a considerable quantity of mill-offals. This would have enhanced the economy of the ration even further.

Free Choice Grain and Meat-and-bone Meal

This experiment, which commenced at Kairi Regional Experiment Station during 1958, concluded in March 1959. Three groups of approximately 45 pullets in each were fed whole sorghum and meat-and-bone meal. Three groups were fed on whole maize and meat-and-bone meal and a further three groups fed an all-mash ration containing equal parts of crushed maize and sorghum in addition to meat-and-bone meal. All rations were supplemented with vitamins A and D₃ and manganese sulphate.

The results obtained from this experiment are set out in Table 3.

TABLE 3
RESULTS OF FREE-CHOICE GRAIN AND MEAT-AND-BONE
MEAL FOR A LAYING PERIOD OF FIFTY-TWO WEEKS

	Free Choice Maize	Free Choice Sorghum	All Mash
Number of pullets in test ..	134	132	133
Per cent. deaths	7.5	6.8	6.0
Production per bird (eggs)			
housed ..	130.1	122.8	139.1
Total food eaten (pounds) ..	10,373	9,764	9,991
Per cent. of total intake as :—			
Maize	75.8	..	..
Sorghum	..	79.6	..
Meat-and-Bone Meal ..	24.2	20.4	(at ration level 12.5%)
Lb. feed/dozen eggs	7.14	7.23	6.48
Total cost of feed eaten	£ s. d. 120 12 4	£ s. d. 97 2 8	£ s. d. 104 8 5
Cost per pound (pence) ..	3.18	2.71	2.73
Cost per dozen eggs (pence) (Kairi prices) ..	22.70	19.59	17.69

Production from all three groups was much lower than expected. The pre-laying history of acute intestinal coccidiosis followed by an outbreak of fowl pox would have in no small way affected the potentialities of these layers. The results to date indicate that there would be some merit in the system of free-choice whole-grain feeding in grain-growing areas where sideline production is common. The experiment does indicate that the whole-grain fed groups ingested nearly twice the amount of animal protein that the all-mash fed birds did without any improvement in production. From a State viewpoint this would be wasteful of a most important prerequisite for any poultry ration.

Because of the early setbacks by the stock in this trial it is proposed to repeat the work in the coming year.

Winter Lighting Trial

One row of pens at the Kairi Regional Experiment Station has been equipped with electric lights and a suitable time switch installed. Day-old pullets hatched early in June are now being reared for a winter lighting trial during 1959-60. It is considered that the demonstration of the advantages of winter lighting on egg production may boost the output of eggs in North Queensland during the winter months and so reduce the spring surplus from these farms. Commercial producers in Cairns and on the Atherton Tableland have to meet serious competition from small farm flocks during the months of August to October.

Half-Sister Breeding Scheme

An excellent row of breeding pens was erected at the Poultry Section of the Rocklea Animal Husbandry Research Farm, and is now being used to carry out a breeding scheme based on half-sister family performance. This scheme is identical with those in progress on the majority of co-operating breeding farms. Twelve families of White Leghorns are being tested. The scheme is now in its second year and already a marked improvement is noted. This improvement is paralleled in the better performance of a sample of these families in the current Random Sample Test.

Broiler Investigations

The need for a broiler or meat-type chicken has already been stressed. It is considered that the Department should give a lead in this matter. A small flock of the New Hampshire breed was hatched and reared at the Rocklea Farm during 1958. All females have been trapezoid. Mating up will take place very shortly and future breeding stock will be selected for fast feathering. Light Sussex day-old chickens are being introduced in July and Indian Game when available. Preliminary investigations will largely centre around the simple crossing of New Hampshire and Light Sussex; Indian Game and Light Sussex; and White Leghorn and Indian Game.

Whalemeal Investigations

A supply of whalemeal from the last season's catch was used in a chick growth trial at the Rocklea Farm to see whether the haemorrhagic symptoms which occurred consistently when a previous batch of whale meatmeal was fed would occur. The experimental procedure and rations used were identical with past trials of this nature. The chicks fed rations containing whale meatmeal did just as well as those fed a good quality meat-and-bone meal. The remainder of this batch of whalemeal is being held at room temperature and will be used again during 1959-60, to see whether length of storage causes some toxic principle to develop or inactivation of vitamins E or K to take place, thus leading to the occurrence of the haemorrhagic symptoms.

Effect of Calcium Supplement and Vitamin D₃ on Eggshell Thickness

This pilot trial was carried out at the Rocklea Farm, using single laying cages. The stock used were White Leghorn X Australorp crossbreds hatched in March 1958 so that they would be in full production during the summer months.

Eight treatments were used, each treatment being replicated three times with eight layers in each replication. Four of the rations contained vitamin D₃ at the level recommended by the National Research Council of the United States, whilst vitamin D₃ at twice this level was added to the other four rations.

The four rations with the accepted vitamin D₃ level were based on a common all-mash formula to which the following additions of calcium either as shell grit and/or ground limestone were made:—no addition of calcium (control); shell grit supplied free choice; 5 per cent. ground limestone incorporated in the mash without additional shell grit; 5 per cent. ground limestone and shell grit free-choice. The other four rations, apart from double the level of vitamin D₃, were identical in composition. All eight rations were fortified with stabilised vitamin A in identical amounts.

One egg per week from each layer was broken out during the 5 months' period of the trial and shell thickness measured in three places. Over 3,000 eggs were examined during this trial and 9,000 individual measurements made. The final analysis and interpretation of these data have not been completed but the following general observations can be made.

No immediate significant difference in shell thickness was noted between treatments with calcium supplements. The addition of extra vitamin D₃ did not appear to increase shell thickness. It was observed that the eggs from the hens on 5 per cent. ground limestone but without additional shell grit had a chalkier shell and breaking strength did not seem as good as in other treatments.

The behaviour of the layers without calcium supplements was rather striking. Eggshell thickness did not appear to be greatly affected. The layers endeavoured to adapt themselves to the situation by laying a few eggs then pausing for one or two weeks before commencing to lay a few eggs once more. Very few soft-shelled eggs were laid. However, mortality in these groups was much higher than in the groups fed calcium supplements. Deaths reached 25 per cent. and most of these were due to "rickets".

Artificial Lighting Experiment

This trial commenced at the Rocklea Farm in October 1957 and concluded in September 1958. Artificial early morning lighting commenced on Mar. 10, 1958. Average

age production per bird for the whole experimental period irrespective of lighting was of the same order. However, when the average production of the two groups was compared over the period when lights were operating, i.e., March to September, the "lit" group averaged 8.77 eggs per bird more. On closer examination of the monthly lay during the period of high egg prices in 1958, i.e., March to July, the distinct advantage of lighting suitable age groups is shown by the fact that the groups subject to lighting produced 14.7 eggs more per bird. This would have meant an additional 4s. net profit per bird.

PULLORUM TESTING AND DISEASE CONTROL

Table 4 sets out the pullorum testing results for the year. It will be noted that there is an increase in the number of flocks which gave no reaction at test. The overall State percentage is higher than last year, but this was due to a number of reactors detected in flocks other than those owned by registered stock suppliers.

TABLE 4
PULLORUM TESTING STATISTICS, 1956-57 TO 1958-59

	1956-57	1957-58	1958-59
Total number of fowls tested	226,571	220,300	225,484
Number tested for registered stock suppliers	224,689	215,666	219,920
Number of registered stock suppliers' flocks tested ..	139	124	131
Number of flocks with no reaction at test	84	68	78
Percentage reaction for State	·15	·07	·13

During the year under review, the responsibility of disease control was passed to the Veterinary Services Branch. This has allowed more time to be spent on husbandry problems and opened the way to hitherto unexplored avenues of endeavour in poultry husbandry.

DIVISION OF DAIRYING

The Division had a busy year in all its fields of operation, comprising research and laboratory control services, farm demonstrations, extension, regulatory work and production recording of herds.

RESEARCH

The results of research work in several directions became apparent during the year.

Following experimental work on filtration of cream at butter factories by officers of the Division of Dairying, which is believed to have been the pioneering work on this problem in Australia, it is pleasing to see a determined effort being made by butter factory managements to reduce the incidence of extraneous matter in butter. Results of the investigational work have been translated into factory practice in a very short time and during the past year the samples of butters examined in the laboratory which had unsatisfactory extraneous matter tests was 5 per cent., compared with 25 per cent. in the previous year.

In association with the Butter Marketing Board and two factories, efforts were made to produce a butter which contains a fuller flavour. This was successfully accomplished and a trial shipment of this type of butter is soon to be sent to Britain to assess its possibilities for that market.

Departmental officers have been actively associated with the experimental manufacture of rindless cheese for export. At two factories 150 vats of cheese were made during the past year and exported to England. The cheese arrived in good condition and attracted a premium of 18s. 9d. per cwt. over waxed cheese. It is clear from the trials that only high quality cheese is suitable for export in this form.

Demonstrations conducted in an effort to improve the compositional quality of milk during the normally dry winter and spring months showed how an appreciable improvement in total milk yields and the arrest of the seasonal drop in compositional quality could be achieved.

Weed taint was again responsible for rather serious degrading of butters during the winter and spring months. All indications over recent years are that the weed taint problem is becoming accentuated. Some experimental work is already being undertaken on spraying weeds with hormone weedicides and controlled grazing. Limited trials on controlled grazing during the year revealed that the intensity of weed taint in cream and the resultant butter can be minimised if a herd can be removed to weed-free pasture at least four hours before milking.

LABORATORY CONTROL SERVICES

A gratifying feature of the year's results of these services and an indication of the increasing awareness of the desirability to supply consumers with high quality dairy products was the improvement in the standards of hygiene and processing at factories. An increasing number of milk factories is extending the control exercised over milk quality by providing equipment for carrying out thermoduric tests on suppliers' milk samples, in addition to the methylene-blue test, which is a compulsory requirement. Eleven Associations are now equipped for conducting this test. Where necessary, officers of the Dairy Research and Field Services Branches collaborated in advisory visits to factories and farms, and there was close liaison between officers of the Branches to ensure the effective use of the results of laboratory tests.

FARM DEMONSTRATIONS

Demonstration projects under the Commonwealth Dairy Industry Extension Grant were conducted on 114 farms. They were mainly connected with rain-grown and irrigated pastures and various aspects of dairy hygiene, and included four water-harvesting demonstrations. On six field days conducted on these farms the average attendance was 55.

EXTENSION

The extension activities of field officers of the Division of Dairying have been appreciably strengthened in recent years, particularly by means of group and mass extension methods. During the year there were 24,588 individual farm visits, 11,000 office discussions with farmers, 23,969 attendances at film nights, farm walks, conducted tours, field days, method demonstrations and other extension projects, a total of over 59,000 contacts between officers and producers through extension media.

The Dairy Extension Advisory Committees operating in the nine Q.D.O. District Council areas are now in their second year of work. Industry representatives have exhibited a keenness to work side by side with Departmental officers on matters affecting the industry, and this blending of ideas and experience is assisting the work of extension. These committees are proving active in the promotion of recommended practices such as fodder, water and soil conservation, pasture improvement, supplementary feeding, tick and worm control and improved dairy hygiene. The Central Committee this year requested each Dairy Extension Advisory Committee to submit a programme of work for the 12 months. This will enable a more orderly and planned approach to be made to the work to be carried out. A large number of field events and film evenings has been sponsored and organised, and farmers' schools have been held. These featured maintenance and improvement of soil fertility and dairy hygiene.

The most ambitious event yet undertaken by a D.E.A. Committee was the Farmers' Festival organised by the Eastern Downs Committee. More than 9,000 people attended and watched machinery demonstrations of all kinds, crop spraying by aeroplane, dairy machinery, dozing and earth-moving, green-crop harvesting for silage, irrigation, etc. The Festival was so successful that it is being repeated in 1959.

HERD PRODUCTION RECORDING

In 120 herds entered in the Pure Bred Production Recording Scheme 1,936 cows completed a lactation for an average yield of 288 lb. butterfat. The percentage of recorded cows which satisfied the production standards for entry into the advanced register of dairy cattle breed societies was 36. Sire surveys were made on 74 pure bred bulls in stud herds. Thirty (40.5 per cent.) showed the capacity to raise the productive level of cows with which they were mated, 10 (13.5 per cent.) were able to maintain it and 34 (45.9 per cent.) lowered production. The number of pure bred cows which qualified for entry into the various sections of the register of merit was 122.

Sire surveying and registers of merit are creating wide interest among breeders and commercial dairymen, and there is evidence that farmers are gaining an increasing appreciation of the need to have information from

more than a single lactation record for assessing the merit of a cow or selecting one of her male progeny as a herd sire likely to improve the genetic quality of their stock.

The number of herd recording groups in operation during the year was 72, compared with 80 in the preceding year. The recorded herds totalled 1,217, in which 43,726 cows completed lactations, the average yield being 345 gal. milk and 143 lb. butterfat. The average length of lactation in recorded herds has increased since 1951 from 203 to 247 days. It is encouraging to report that increasing numbers of owners of grade herds are requesting surveys of their herd sires. During the year 248 bulls were surveyed, compared with 138 in 1957-58. Of these, 22.5 per cent. were raising production, 67 per cent. maintaining it, and 10.5 per cent. lowering it in the herds in which they were used.

A survey revealed that a dry period of longer than nine weeks before calving is not conducive to higher production from a cow in the ensuing lactation period. Thirty per cent. of the cows were dry from four to nine weeks, 42 per cent. from nine to 16 weeks, and 28 per cent. longer than 16 weeks. It is clear that production is being lost through the unnecessarily long dry periods of many cows in Queensland herds; they are consuming fodder at the expense of cows which calve more regularly.

The Chief Adviser of the Herd Recording Section visited New Zealand to study herd recording technique in that country, and as a result it is intended to incorporate some features of the New Zealand scheme into the production recording scheme in this State.

LEGISLATION

There is a world-wide trend for the diversification of the products made in dairy factories; this assists in enabling production to be switched from time to time, according to the demands and price fluctuations for the various products.

With a view to assisting factories to diversify production and to extend into new products fields, the Dairy Produce Acts were amended to overcome certain restrictions which hitherto existed regarding separators in factories. Adequate safeguards have been provided in the amendment of the Acts to enable control over the use of separators, and the partial separation of milk intended for the market milk trade is forbidden.

In some countries a substitute milk in which the butterfat is entirely replaced by vegetable oils has been produced. Dairy industry organisations through Australia were concerned about the threat of such products if introduced into Australia. The matter was considered by the Australian Agricultural Council, which decided that appropriate legislation to ban the manufacture and sale of filled milk should be taken by each State Government. The appropriate legislation was passed in Queensland.

The *Margarine Acts*, 1910 to 1939 were repealed and a new Margarine Act was passed. The most important provisions of the new legislation specify two types of margarine (table and cooking), provide conditions as to the wording which may be printed on the labels of wrappers in which margarine is packed, make it unlawful for any margarine manufacturer to use in his brands or advertisements any words or pictorial device which suggest any connection between margarine and dairy products, and fix the maximum quantity of table margarine which can be manufactured in Queensland at 4,236 tons yearly. This quantity can only be modified by amendment of the Act.

GENERAL

A further step was taken by Dairy Associations to provide milk supplies to western towns where deficiencies had existed during certain times of the year. The Port Curtis Co-operative Dairy Association commenced to supply milk to towns on the central-western railway, milk being sent in cooled rail waggons. A milk bottling plant was opened at Mount Isa. The milk is forwarded to this town from the Malanda factory on the Atherton Tableland, a distance of about 1,000 miles. The Toowoomba factory of the Downs

Co-operative Dairy Association, which has been supplying milk to towns on the main western line for the past four years, extended its service during the year to Windorah. The milk supplies are sent by railway to Quilpie and then by aeroplane.

Arrangements were made for the Bread Research Institute in Sydney to carry out trials with samples of buttermilk powders from Queensland factories. These gave satisfactory bread baking results. If the demand for milk bread grows in Queensland, buttermilk powder could be more readily produced than skim-milk powder. There are large quantities of buttermilk available at all butter factories, whereas production of skim-milk powder would involve major changes in some factories because of the necessity to receive wholemilk from the farms, separate it and dry the skim-milk. As with skim-milk powder, certain ingredients would have to be added to buttermilk to give the desired loaf texture.

There were adequate quantities of milk available for the requirements of the market milk trade throughout the year in all parts of the State. An amendment of the Food and Drug Regulations provided standards for two new types of cream in addition to the previous 35 per cent. fat content table cream. These were a dessert cream of not less than 18 per cent. butterfat, and a whipping cream of not less than 42 per cent. butterfat. There was a slight, but not very significant, upward trend in fresh cream sales following this action.

The Biddeston cheese factory, one of the oldest in the State, discontinued operations during the year and the Sunnyvale cheese factory also was closed.

The striking change in the manner of presentation of cheese on the local market, which had taken place in the previous two years, was further extended in the year under review. Almost half of the cheese produced for local sale is now packed in consumer-size, rindless pieces. Officers of the Division have given much assistance to factory managements in connection with problems associated with producing cheese suitable for these new methods of presentation. A pleasing feature of the improvement in cheese quality of recent

years and better packaging methods is the increasing sales of cheese. Some problems which have arisen in regard to the quality of cheese and surface defects are under investigation.

The Australian cheese industry voluntarily decided that from Jan. 1, 1959, only waxed cheese would be exported to England. Investigations have continued on the waxing of cheese, particularly in an effort to devise a wax which leaves a film on the cheese not subject to shattering and cracking. The inclusion of a proportion of petroleum jelly in the wax blends is proving satisfactory in avoiding this trouble. It is clear from reports on waxed cheese in England that factories will need to control the humidity in cheese-holding rooms if surface defects are to be minimised.

The progressive policy of the cheese industry in recent years and its readiness to apply the findings of research are giving results from which the industry must derive benefits by way of increased consumer appreciation and consumption of cheese. At a Conference of the Australian Cheese Manufacturers Association held in Brisbane during the year it was revealed that there are now 32 different varieties of cheese produced in Australia. In addition to cheddar cheese, Gruyere and Roman cheeses have been made at one Queensland factory for many years, but in the past few years a few other factories have commenced to make small quantities of gouda, edam, taffel, clove, smoked and caraway seed cheeses.

STAFF

One officer visited New Zealand to study herd recording and another carried out an assignment in Thailand under the Colombo Plan. The Director of the Division contributed a section for a monograph on milk hygiene which is being published by the World Health Organisation in several languages as a major reference work on the subject.

The officers have generally zealously performed their duties during the year.

FIELD SERVICES BRANCH

The main items on which field officers concentrated their attention during the year were further improvement to the quality of dairy products, provision of satisfactory dairy premises and equipment, promotion of herd recording, and organisation of the numerous extension functions. The return to improved seasonal and economic conditions assisted officers to some extent with this work during the year.

DAIRY PREMISES AND EQUIPMENT

Hygiene

The standard of hygiene on farms supplying market milk and milk for cheese manufacture is generally higher than on farms producing cream for butter manufacture. This is due to the higher price paid for milk. It is clear that even in Queensland's subtropical climate good quality is attainable if there is sufficient inducement to maintain a high standard of hygiene and to provide efficient cooling. One of the main contributing factors to poor quality which was evident during the year on farms was the use of rubberware after it had reached a stage where it should have been replaced. Lack of finance also retarded the provision of adequate water supplies without which good hygiene is difficult. Numerous method demonstrations proved effective in showing farmers the correct methods of cleaning milking machines and dairy equipment.

Dairy Premises

The number of new premises constructed was a little lower than for a good year, but most of those which were built were of high standard. There is a definite trend in this direction as farmers come to realise that nearly half of their waking hours need not necessarily

be spent in drab, unsatisfactory milking sheds. An increase in the number of satisfactory premises depends on the future prosperity of the dairying industry. Despite the reverses of the past two years, however, progress made in the building of new dairy premises has been encouraging and every district in the State has some outstanding dairies which present attractive patterns for others to follow. It is likely that increasing numbers of farmers with large herds will turn from the present walk-through type of shed to the herringbone type, a few of which have recently been built in Queensland.

Hot-Water Facilities

As electricity extends in farming areas it is found that farmers are discarding other types of hot-water facilities in favour of electric water heaters. This is a change to be commended, as this type of heater is convenient. However, some farmers are not using electric boilers efficiently, as they do not use the booster switch, without which water cannot reach boiling point. Efforts are being made by field officers to overcome this problem by pointing out the bacteria-destroying properties of boiling water in adequate quantities and the inefficiency of water at lower temperatures.

Cooling of Milk and Cream

At the annual conference of the Dairy Factory Managers and Secretaries Institute, held in Brisbane, the Oakey Co-operative Dairy Association won eight first prizes, including the Centenary championship for local butter. It was stated by the manager that the reason for this outstanding success was the high quality of the cream, most of which had been stored in refrigerators on the farms. This indicates the great possibilities which

lie ahead for quality improvement when greater numbers of farmers install refrigerators. In 1957-58 there were 2,135 refrigerators in use, and now there are approximately 2,500. Most of these have been installed on farms supplying market milk. Many cream suppliers who do not receive returns comparable with those of milk suppliers are hindered by lack of finance and incentive from purchasing costly refrigerators. It is hoped that these farmers will be catered for in the near future by a less expensive but nonetheless efficient in-the-tank type of refrigerator.

Some factories supplying market milk have offered incentive payments for quality, and this has resulted in the installation of improved cooling facilities and the adoption of improved cleaning methods. One Board of Directors decided that the production of quality milk should be made financially attractive, so that installing a refrigerator would become a sound economic proposition. This Board established for milk with a methylene blue test of four hours or more a margin of 1/3d. per lb. butterfat above the price of unqualified milk. This financial incentive, aided by the goodwill of the producers, had the desired effect, and of the 29 milk suppliers 20 installed refrigerators. Another Association pays suppliers 1d. per gallon premium for refrigerated milk, and as a result many refrigerators have been installed.

Milking Machine Testing Service

This service was again carried out by field officers and was much appreciated by dairy farmers. Examinations of 881 milking machines were made during the year with airflow meters and vacuum recorders, and an analysis of the results compares very closely with last year's analysis. This showed that 66 per cent. had insufficient reserve air, 34 per cent. of vacuum pumps were worn, 12 per cent. were too slow, 6 per cent. too fast and 5 per cent. too small. The majority of vacuum gauges proved to be inaccurate and excessive air leaks, faulty vacuum control valves, pulsators and releasers were found in large numbers of the machines. Excessive air leakage was a common fault. Only 9 per cent. of the machines examined were considered to be without faults. This unsatisfactory position indicates the necessity for Dairy Associations to take an active part in this work, as field officers can examine only a small percentage of milking machines.

On account of the high cost, few milking machines made of stainless steel material are as yet being purchased, whilst those equipped with glass pipelines are, so far, manufactured by only one firm.

There is a need for a reliable milk measuring and sampling device to measure the volume of milk from cows milked by the releaser type of milking machine.

A locally made milk flow meter was obtained and tested by this Department, but was found to contain some irregularities.

FARM PRACTICES

Fodder Conservation and Pastures

Greater quantities of fodder were conserved during the year than previously. In some districts the amount conserved was three or four times greater than had hitherto been stored. The favourable conditions which prevailed over the summer period were conducive to fodder conservation as surplus crops were available. The poor demand which existed for hay and the unsatisfactory price for grain meant that large quantities of both, instead of being sold, are now stored on farms. In addition, there are thousands of acres of maize yet to be harvested, and no estimate can be made as to the amount which will be harvested. This, or portion of it, may be stored as an insurance against drought. Assistance and encouragement in fodder conservation have been given to farmers in the Gympie district by The Nestle Company (Australia) and good progress has been made in this district in conserving fodder. There has also been an increase in the number of contractors prepared to ensile or bale, whilst the number of privately owned machines has increased. A number of farm machinery pools has been formed. From these various activities it is evident that many farmers are better prepared than in previous years for a dry spell.

The steady trend towards improved pastures continued and both rain-grown and irrigated pastures have been sown by increasing numbers of dairy farmers.

Seasonal Calving

The practice of calving the whole, or a big percentage, of the herd within a limited and most favourable period is now practised by approximately 5,500 dairy farmers, compared with 5,000 last year. Although the benefit of increasing production by this practice has been amply demonstrated, the cost of providing a bull paddock has deterred many from doing so.

COMMONWEALTH DAIRY INDUSTRY EXTENSION GRANT

Dryland pastures sown in previous years were consolidated. New projects sown in the autumn of 1959 received a severe setback due to the hot, dry spell. Irrigated pastures did well but grazing management is one practice which calls for greater attention. Water harvesting demonstrations were approved on four properties and results are awaited with interest by district farmers.



Plate 34.—Water Harvesting on a Cooroy Dairy Farm. The dam holds nearly 7 million gallons.

The number of fodder conservation demonstrations continued to expand and created much interest. Prior to the disastrous 1951 drought the amount of silage made in the five main dairying districts of the State was 10,000 tons annually. Between the 1951 and 1957 droughts the amount increased to 15,000 tons annually. In 1958-59 about 58,000 tons were conserved. Future fodder demonstrations will feature easier methods of feeding out the silage.

At June 30, 1958, there were 147 farm demonstrations. During the year 52 of these were terminated, while 19 new projects were approved, leaving 114 co-operators at June 30, 1959. Projects consisted of 63 on rain-grown pastures, 18 on irrigated pastures, 4 on water harvesting, 27 on fodder conservation, 1 on gully reclamation, and 1 on the control of evaporation from water storages.

Six field days were held during the year on C.D.I.E.G. farms, and one was included in a conducted tour. Attendances averaged 55 people.

EXTENSION WORK

Prior to 1955 the main work of extension was carried out by farm visits, when approximately 23,000 visits to dairy farmers were made annually. At that time there were more than 20,000 dairymen in the State, which meant, roughly, that the officer called on each farmer once per year. To improve this position it was decided to carry extension to groups of farmers and since then various extension media have been employed in the form of field days, illustrated talks, farm walks, conducted tours, method demonstrations, annual herd recording meetings, film evenings, junior farmers' meetings, discussion groups and Q.D.O. meetings.

In the past year the number of farm visits was increased to 24,588, and the total attendance at various meetings and other means at which group extension methods were used was raised to 23,969, making a total of 48,557. The number of extension contracts was thus doubled, compared with 1955. In addition, more than 11,000 calls were made by farmers to the officers of the country staff for information and advice, and large numbers obtained information from officers at the dairy exhibits staged at country shows.

Film Nights.—The encouraging response to educational films indicates that dairy farmers are ready to attend in large numbers if suitable films are available. A colour film featuring dairy hygiene and titled "It's In Your Hands" was recently completed by the Commonwealth Department of Primary Industry. A copy made available to this Department will shortly be shown in country centres, where it should prove of considerable assistance to officers in their endeavours to improve the quality of milk and cream. More Australian films of this standard would be well received by the farming community. The Branch now has three projectors and these are in almost constant use. Films were shown to appreciative audiences at the numerous annual herd recording meetings, and at discussion group and Dairy Extension Advisory Committee meetings.

Farm Walks.—This method of extension is proving popular with farmers and several have been organised with a view to showing small groups improved pastures, improved calf-feeding facilities, modern dairy buildings, fodder conservation, etc. Farm walks are easily arranged and are appreciated because of their informal nature and the fact that farmers are seeing something which they could possibly emulate on their own farms. They also give them the opportunity of discussing with the owner his methods and results.

Conducted Tours.—Fifteen conducted tours were organised by officers and attendances of more than 300 on a single tour were reported. This indicates the appeal of visual education. Tours have embraced visits to butter factories, irrigated pastures, water conservation projects, artificial breeding centres, model dairy premises and so on.

Field Days.—Thirty-nine Field Days, including the Farmers' Festival at Toowoomba, attracted a total of 14,285 farmers. At one or two of these days milking machines were erected by officers in the open so that the cleaning, care and maintenance of machines could be demonstrated to larger numbers than would be possible inside a milking shed. The qualities and uses of various detergents were demonstrated, the use of laboratory equipment was explained and shown, and the advantages of modern dairy premises and equipment were impressed on spectators by means of models and plans. Other field days embraced water conservation, improved pastures, soil conservation, irrigation and strip grazing.

Method Demonstrations.—Method demonstrations have proved a valuable means of demonstrating recommended practices to small groups of farmers. They were used effectively in the drive to reduce the thermogenic bacteria count in market milk. Proper methods for the cleaning of milking machines, the removal of milkstone from dairy equipment, hygienic milk production and cooling have been explained and shown, particularly to market milk suppliers.

Junior Farmers' Organisation.—This organisation looks continually towards officers of this Department for advice and assistance, and this has been encouraged by officers, who have attended club meetings and field days, shown films, acted as Advisers on Committees and adjudicated at zone contests. The good relationship thus being built up augurs well for effective extension in the years to come.

Discussion Groups.—Attendances at the Pittsworth, Warwick and Goombungee Discussion Groups meetings have been good and ranged from 35 to 55. The meetings have been marked by the enthusiasm of members. A meeting decides on a topic for the next meeting and nominates the speakers. One is usually a guest speaker and one a farmer member. Subjects discussed have been irrigation, artificial breeding, diseases in pigs, herd recording and animal breeding. There is a keenness among these groups to adopt sound practices on their farms.

Other Matters.—Continued use has been made of publications and radio to advise producers of improved practices. Field officers have contributed advisory articles to local papers, which have co-operated in printing such material. Fourteen articles were published in the *Queensland Agricultural Journal*, 22 News Bulletin items were prepared and three A.B.C. "Country Hour" broadcasts were delivered.

DAIRY EXTENSION ADVISORY COMMITTEES

The Committees operating in the nine Q.D.O. District Council areas are now in their second year of work. Industry representatives have exhibited a keenness to work side by side with Departmental officers on matters affecting the industry, and this blending of ideas and experience is assisting the work of extension. These committees are proving active in the promotion of recommended practices such as fodder, water and soil conservation, pasture improvement, supplementary feeding, tick and worm control and improved dairy hygiene.

The Central Committee this year requested each Dairy Extension Advisory Committee to submit a programme of work for the 12 months. This will enable a more orderly and planned approach to be made to the work to be carried out. A large number of field events and film evenings has been sponsored and organised, and farmers' school have been held. These featured the maintenance and improvement of soil fertility and dairy

hygiene. The most ambitious event yet undertaken by a D.E.A. Committee was the Farmers' Festival organised by the Eastern Downs Committee. More than 9,000 people attended and watched machinery demonstrations of all kinds, crop spraying by aeroplane, dairy machinery, dozing and earth moving, green-crop harvesting for silage, irrigation, etc. The Festival was so successful that it is being repeated in 1959.



Plate 35.—View of the Central Display Area at the 1958 Farmers' Festival. Machinery demonstrations were conducted elsewhere on the farm.

HERD PRODUCTION RECORDING

Herd recording activities were below expectations during the 1958-59 year. The number of herds recorded showed only a slight increase since the drought of the previous year despite the improved seasonal conditions.

Although herd recording information is basic to herd improvement, only 6.5 per cent. of dairy farmers are recording their herds. On numerous farms where recording has been practised for a number of years increased production per cow has been achieved. One outstanding case is that of a North Coast farmer whose herd averaged 113 lb. fat when he commenced recording in 1954. After culling and concentrating on improved pastures, the average rose to 218 lb. fat in 1958.

A conference of various bodies connected with the dairying industry was held in June to discuss the rules governing the Pure Bred Production Recording scheme and suggest methods to encourage more farmers to record their herds under the Group Herd Recording Scheme. The conference was attended by delegates from the Stock Breeders' Association, Queensland Dairymen's Organisation, Australian Primary Producers' Union, Queensland Co-operative Dairy Companies Association, Faculties of Agriculture and Veterinary Science of the University, and Departmental officers.

The rules dealt with were those which stated the portion of the herd to be recorded, length of lactation and age production standards. Opinions favoured the formation of local committees to foster the recording of grade herds and a close liaison with the Department and the Queensland Dairymen's Organisation with respect to herd recording.

During the year the Chief Adviser of the Herd Recording Section visited New Zealand and studied the system of herd testing in that country. As a result it is expected that a number of practices noted during the visit will be adopted in Queensland and these should assist in improving the service to farmers in this State. These practices include the introduction of a composite

herd sample as a means of checking the accuracy of the recorder's work; and an improved method of sampling and the gradual replacement of the Babcock method of testing by the Gerber method. The New Zealand recruitment of new group members and the training and supervision of recorders are being studied with a view to their implementation. A study was made of sire surveying methods and the proving of bulls, and the knowledge gained will be used to advantage in future work.

Purebred Production Recording

Prior to July 1, 1958, herd owners were required to record only those animals which were under the age of five years at the time of calving. The rules governing the scheme provided that after July 1, 1957, all females in the herd were to be recorded. Owing to the then existing drought, however, the enforcement of this rule was deferred until July 1, 1958.

The recording of the whole of the herd will allow a better evaluation of pure bred herds to be made. In the past, herds have been rated on the performance of a few animals only. A more reliable method of sire surveying will now be possible, as a comparison can be made of the production of a bull's daughters with that of the rest of the herd. The increasing demand for artificial breeding makes it necessary to remove any doubt as to the quality of bulls.

The necessity to submit the whole of the herd resulted in some breeders withdrawing their herds from recording. However, the number of other breeders who commenced recording compensated for the withdrawals.

During the year cows from 120 herds were submitted, compared with 118 in the previous year. This represents only 10 per cent. of the members of the five Herd Book Societies in Queensland.

The required age production standard was reached by 808 cows compared with 660 last year, while 1,128 failed and 313 were withdrawn.

The average production of all cows was 288 lb. fat from 1,936 cows, compared with 281 lb. fat from 1,738 cows in 1958.

The numbers of cows of each breed which completed a recorded lactation of 300 days or less together with their average productions are shown in Table 1.

TABLE 1
AVERAGE PRODUCTION OF PUREBRED COWS, ACCORDING TO BREED

Breed	No. of Cows	Average Production		
		Milk	Test	Butterfat
		Lb.	%	Lb.
A.I.S.	803	7,193	4.0	287
Ayrshire	54	8,175	4.2	343
Friesian	90	8,325	3.4	284
Guernsey	144	6,113	4.5	272
Jersey	845	6,537	4.4	288
Total	1,936	6,906	4.2	288

Sire Surveys.—For the first time in Queensland a brochure was issued showing the results of surveys carried out on bulls used in recorded stud herds.

The numbers of bulls of each breed which were surveyed and their ability to raise, maintain, or lower production are shown in Table 2.

TABLE 2
SIRE SURVEYED AND THEIR PERFORMANCE

Breed	No. of Bulls	Number of Bulls		
		Raising Production	Maintaining Production	Lowering Production
A.I.S.	36	15	4	17
Ayrshire	1	..	1	..
Friesian	2	2	..	..
Guernsey	2	1	..	1
Jersey	33	12	5	16
Total	74	30	10	34
Percentages ..	..	40.5	13.5	45.9

Register of Merit.—The Register of Merit is obtaining greater recognition by dairy farmers each year. Many who previously bought bulls from dams which had qualified for entry into the Advanced Register of the appropriate herd book are now selecting them from Merit Register cows.

During the past 12 months no cows qualified for entry into the Elite section of the Register, the requirement for which is a minimum production of 3,600 lb. butterfat. Thirty-two cows entered the Lifetime section (2,240 lb. fat), compared with 15 in 1957-58. Ninety animals were admitted to the Intermediate section (102 last year).

The number of cows in each breed admitted to the various sections of the Merit Register during 1958-59 are shown in Table 3.

TABLE 3
COWS ADMITTED TO THE MERIT REGISTER IN 1957-58

Breed	Section of Register		
	Elite	Lifetime	Intermediate
A.I.S.	—	18	56
Ayrshire	—	1	5
Friesian	—	—	3
Guernsey	—	—	5
Jersey	—	13	31
Total	—	32	90

Group Herd Recording

The membership of herd recording groups did not show the anticipated increase during the year. This can be attributed to the depressed prices overseas for dairy produce and the increased herd recording fees. Following the 1956-57 drought there were 71 recorders operating 80 groups in June 1958. Owing to low membership a number of groups were amalgamated and at present there are 72 groups serviced by 71 recorders.

Increases in the State basic wage have resulted in a higher cost of recording. On Oct. 1, 1958 the fee to the farmer was raised from 8s. 6d. to 10s. per cow per lactation. This was ensure that the fees collected from farmers would be sufficient to cover 37½ per cent., which is the share to be borne by them. Office costs are not included in the farmer's portion, as they are borne by the Commonwealth Dairy Industry Extension Grant. Costs are being closely scrutinised and a recent survey was made to dissect the costs. Wages of herd recorders and pay roll tax account for 83 per cent. of the total cost, motor vehicle mileage 13 per cent., apparatus 2 per cent., and incidentals 2 per cent.

The 1957-58 herd recording year ended on Sept. 30, 1958. In that year, 43,726 cows from 1,217 herds completed recorded lactations in this period for an average production of 345 gal. milk and 143 lb. fat. This was a drop of 5 gal. milk and 6 lb. fat on the previous year's figures. These results, however, were affected by the 1956-57 drought.

Average Length of Lactation.—The average length of lactation was 247 days, an increase of 16 days over the previous year. This was very satisfactory, particularly as in 1951 the average length of lactation was only 203 days.

Sire Surveying.—Farmers are realising the benefits to be derived from sire surveying and the numbers of applications received each year from owners of grade cows are increasing. Surveys of 248 bulls were made, compared with 139 in the previous year. Of the bulls surveyed, 22.5 per cent. were raising, 67 per cent. maintaining, and 10.5 per cent. lowering production.

Age Correction Factors.—For the purpose of comparing the production records of cows it is necessary to convert all records to a common basis. For this purpose age correction factors are necessary. A survey was conducted during the year to ascertain if any alteration should be made to the factors which were established eight years ago. Only a slight variation was found.

Alternate Monthly Testing.—As the cost of herd recording is causing concern in Queensland, the possibility of the use of a cheaper method was investigated. The New Zealand alternate monthly system was examined. This is claimed to be satisfactory in New Zealand and may offer a cheaper means of testing to those desiring it in this State.

A survey was made of Queensland data to ascertain if the results would be sufficiently reliable. It was found that when cows had a lactation period of seven or more months the results were reliable for ranking cows for culling or breeding purposes and for sire surveying. The infrequency of testing would, however, limit the usefulness for assessing the value of farm practices. When lactation periods are of six months' duration or less, the results are not so satisfactory. This matter is being further reviewed with a view to determining the practicability of alternate monthly testing in Queensland for farmers who may be willing to adopt it.

Effect of Length of Dry Period.—A survey was conducted on 70,000 cows to ascertain the effect of the length of dry period on production in the ensuing lactation. This showed that cows require a dry spell of 4-9 weeks but a longer dry period is not conducive to increased production. Only 30 per cent. of the recorded cows have dry periods of 4-9 weeks, while 28 per cent. are dry for 16 weeks or more.

DAIRY RESEARCH BRANCH

The function of the Branch is to assist the dairying industry by research and quality control schemes to produce high quality products and to efficiently process them. The research programme of the Branch is orientated towards problems associated with these various facets of the industry.

Approval has been given for the preparation of plans for the establishment of an experimental pilot plant for dairy research. When completed, this plant will enable an extension of projects aimed at solving the technological problems associated with quality improvement, new techniques and the development of new products.

On 38,731 samples of milk, butter, cheese and other dairy products, 122,684 tests were carried out during the year in connection with the laboratory quality control services provided for the dairying industry.

Eleven Associations have purchased bacteriological equipment for the purpose of conducting regular tests for thermophilic bacteria in market milk supplies and have sent factory operatives for training in the method of performing the test and carrying out other simple tests which may be done with limited equipment but which help in factory control. The establishment of laboratories in factories and the appointment of laboratory technicians must play an increasingly important part in improving the technical efficiency of factory operations.

At the request of the South Queensland Egg Marketing Board a laboratory service has been provided to help improve the quality of egg-pulp. With the introduction of pasteurisation of egg-pulp for the first time in Queensland, regular chemical and bacteriological examinations have been conducted. The results indicate that the standard of processing is efficient.

RESEARCH

Emphasis in investigational work has been given to projects aimed at the better utilization of butterfat. In this regard, the production of butterfat spreads, concentrated reconstituted whipped cream, non-cheddar varieties of cheese and cultured butter has largely featured. Much attention has also been given to investigations associated with the further improvement of quality of butter and pasteurised milk.

The main lines of research can be summarised as follows.

Butteroil Products

A process has been devised for the manufacture of flavoured butterfat spreads. They are intended to provide a supplementary use for dairy products on the local market. These spreads can be produced with good keeping quality and flavour at a reasonable price. The process offers a means of reducing the percentage of weed-tainted butter exported, as butteroil made from weedy butter has proved suitable for processing into a good quality spread. Such spreads are adaptable for use as cake-fillings, icings, bread-fillings and for cooking purposes.

A method for the production of concentrated reconstituted whipped cream from purified butteroil has also been examined.

Cultured Butter

The production of a more attractively flavoured butter could help increase consumption on both the local and the export markets. Consequently, in conjunction with the Butter Marketing Board, experiments in the production of butter with enhanced flavour, made from cream to which starter culture is added, have been continued. The best flavour in the ripened cream has been produced by *Streptococcus diacetylactis* cultured in the pasteurised cream to low acidities (below 0.20 per cent.). Butter made from cream in which this organism is grown has been found to possess a good appeal in limited local consumer trials.

It has been found that when the acidities of the cream are kept to low levels, the butter may contain up to 1.0 per cent. salt without any significant falling off in keeping quality over a storage period of five weeks. However, in order to achieve this, finely ground salt containing a small proportion of soda ash has to be used. When untreated salt was used, the keeping quality of the butter deteriorated quickly. This work is continuing in an attempt to increase the salt content to 1.5 per cent., a level more acceptable to Queensland consumers, without causing an appreciable reduction in keeping quality. It is now proposed to have salted cultured butter made at a factory for consignment to the United Kingdom in order to assess its suitability for export purposes. When cream is ripened to low acidities, fat loss on churning is low and no difficulty arises in drying buttermilk by the roller process.

Filtration of Cream

Due to the importance now placed on extraneous matter in dairy produce and the Regulations proposed under the Commerce (Trade Descriptions) Act, which will require milk and cream used for manufacturing purposes to be filtered at the factory, investigations have been carried out on filtering processes.

While the filtration of milk is an established procedure, the filtration of cream is a new undertaking and trial installations of filtering devices have not always given satisfactory results.

Earlier experimental work showed that successful results could be achieved by the use of nylon filter cloth of multi-filament weave and most butter factories have adopted this method. As a result, tests showing unsatisfactory extraneous matter have been reduced from 25 to 5 per cent.



Plate 36.—Filtration of Cream in a Balance Tank.

Different types of American and English nylon commercial filter cloth of various meshes have been tried to determine the most efficient types available. Nylon with apertures ranging from 35 to 200 microns has been tested. The results showed that it was possible to filter cream effectively in both plate and stocking type filters with a nylon mesh aperture of 75-100 microns



Plate 37.—Equipment for the Filtration of Cream in a Butter Factory.

and little or no advantage was gained by the use of finer cloths. Because of the high cost of some filtering devices, cheaper units have been designed by commercial firms and tested by officers of the Branch (Plates 36 and 37).

Investigations have continued into the most suitable position for the filters. Initially, the filter was placed after the pasteuriser because of economy and convenience. However, the protein precipitates caused trouble if the filtering was done after rather than before pasteurisation. The effect of the technique on fat losses in churning is now being examined.

Weed Taint

Weed taint in dairy produce is a major defect of dairy products in Queensland during the late winter and early spring months. Some preliminary investigations on controlling or reducing this defect have been carried out. These indicate that some reduction, even with species of *Lepidium* (peppercresses), is possible by controlled grazing of herds prior to milking. Provided the herd is removed from weed infested pastures 3-4 hours prior to milking, the defect is less pronounced than by allowing free grazing on weedy pastures until milking times.

A number of methods for the reduction of the intensity of weed taint in cream are being examined. These have included use of oxidising compounds, washing of the fatty portion, separation and clarification. This work is to be continued during the approaching weedy season.

Copper Content of Butter

Minute amounts of copper in butter may accelerate oxidation of the fat and thus have a detrimental effect on its keeping quality. A survey of copper contamination in butter has been carried out. The results, which have been published, showed that contamination in many instances exceeded the usually accepted limit of 0.15 p.p.m. Even when a high copper content occurred, the effect on grade scoring was somewhat variable. An attempt is therefore being made to determine the mode of action and the factors responsible.

At the factory level, installation of stainless-steel equipment is helping to reduce the copper content of butter. However, sources of copper contamination on

the farm are being examined, particularly the corrosion of milking equipment by harsh and unsuitable detergents and sterilants.

Steam Use in Cream Pasteurisation

A survey of the average steam requirements for three different systems of cream pasteurisation in use in Queensland factories is being made. By using steam-metering devices, two systems have been under examination. Both showed an average steam consumption of 3 lb. per gal. cream processed. It is hoped to assess the steam requirements of a third system during the next 12 months. The effect of the pasteurisation methods on fat losses in churning is also under examination.

Cheese Packaging and Waxing

With a steady increase in the production and packaging of rindless cheese, there has been a continuing demand for advice and information regarding the various processes. Whereas previously rindless cheese was produced only for the local cheese trade, in the past year over 150 vats of rindless cheese were packaged and shipped, or prepared for shipment, to the United Kingdom. This cheese in rectangular form has been packaged in different types of plastic materials (Plate 38). The cheeses are packed in either pine boxes or fibreboard cartons.

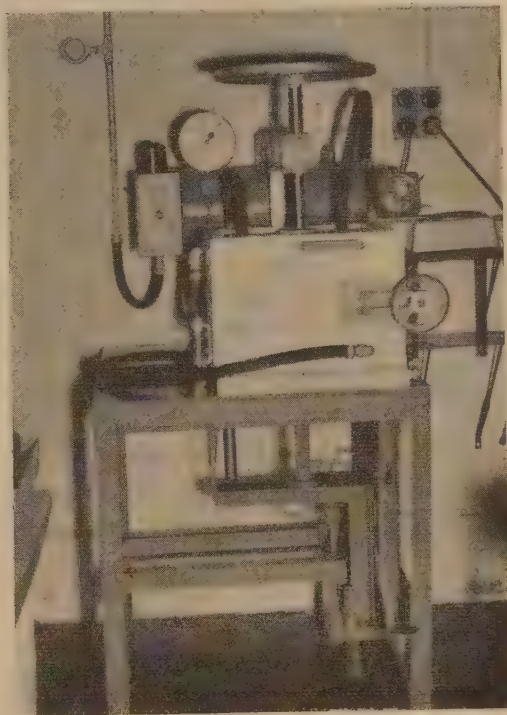


Plate 38.—Equipment for the Packaging of 40 lb. Rectangular Cheese.

This rindless, prepackaged cheese has shown little mould on its surface prior to shipment, but as mould growth is one of the main problems encountered in consumer-size prepackaged cheese the consignments will be closely examined on arrival in London. In the meantime, investigations are continuing with a view to determining the best ways and means of avoiding such defects.

As a large proportion of export cheese must continue to be exported in a bandaged and waxed form, research into the waxing of cheese is being carried out. The best means of preparing cheese for waxing, the compounding of the wax mixtures and the temperatures of waxing are being examined.

Despite the successful results achieved to date in the packaging and waxing of cheese, several fundamental problems remain to be solved. Foremost among these is surface spoilage of the cheese under the coating materials. As a result, the fungicidal treatment of cheese surfaces and other precautions are receiving attention.

The aim of this research work is to land export cheese at its destined market in an attractive, clean condition, free from surface defects.

Non-Cheddar Varieties of Cheese

With a view to increasing the overall consumption of cheese, investigations have been carried out on manufacture of non-cheddar varieties considered to have appeal in this State. Efforts have been directed towards the hard or semi-hard Dutch varieties as it is felt that these types are most suited to Queensland conditions. At one factory, the manufacture of trial batches of Gouda cheese was successful, although some troubles have arisen in regard to flavour development. Experiments are continuing with a view to obtaining the desired flavour.

Considerable success has been attained at another factory in the experimental manufacture of edam, taffel, carraway seed, smoked and clove cheese in loaf sizes. With a view to economy, efforts were made to produce all of these varieties from the one basic curd type.

Salt in Cheddar Cheese

This project has been designed to assess the influence of salt on the quality of cheddar cheese. A total of 40 batches of cheese of various salt contents has now been graded at 2-3 weeks of age. At this age grading results do not indicate much difference between the cheese with different salt contents, though there does appear to be a tendency for cheese with the higher salt content to be the closer in texture. A regrading is to be done at six months of age when the effect of salt on maturation should become evident.

Fermented Cheese

The occurrence in much Queensland cheese of fermented flavour has caused considerable degradings over the second half of the year. The incidence of the problem has been confused somewhat by a change in grading designation. The defect appears in cheese at about three weeks of age and is sometimes accompanied by slightly open-texture indicative of very slight gas production. It appears to be associated in some instances with pH readings slightly higher than normal. Attempts to overcome the trouble by raising the salting rate and increasing acidities during manufacture have not been entirely successful. Rennet and starter cultures as sources of contamination have not been completely eliminated and are still being investigated. Organisms isolated from defective cheese have been inoculated separately into milk and thereby introduced into experimental cheese in controlled experiments. While promising results are being obtained in this regard, the work is as yet incomplete.

Affected cheese has also been subjected to chromatographic analysis with a view to determining any abnormalities in the water soluble amino-acid pattern.

Inhibitory Factors in Cheese-Milk

While the main cause of "slowness" in cheese manufacture is due to bacteriophage in starter cultures, the possible effects of other inhibitory factors in the milk supply cannot be ignored. These are being studied. Churning of the fat resulted in the gradual disappearance of the inhibitory property in the skim-milk fraction. Effects of gaseous oxygen and nitrogen on inhibition have been studied. Nitrogen tended to stimulate the starter strains despite the presence of inhibitory factors in the milk, while oxygen tended to accentuate the inhibition.

The findings of other workers in this field have been confirmed in part, it having been found that susceptible strains rise with the fat globules during creaming. The prevention of cream rising resulted in increased acidity production by susceptible strains.

Compositional Quality of Milk

Wide variations in the compositional quality of milk occur in Queensland. Previous work has shown that this is due to marked differences in the level of feeding of dairy cattle according to seasonal conditions. The variations are manifested in the prevalence of low fat and solids-not-fat percentages in market milk, particularly during the late winter and early spring months and also in lowered yields and defective physical characteristics of cheese. Research on this project has been continued with a view to ascertaining the best ways and means of reducing the seasonal decline in composition and to assess the factors mainly responsible. Where there is a substandard level of feeding of dairy cows, a clear relationship has been shown to exist between the low blood plasma protein content and the low protein percentage in the milk. Increasing the protein intake of the cows substantially raised the protein levels in the blood and milk. Following initial feeding trials with identical twins, the investigations were extended to a commercial dairy herd. It was shown that better-fed cows not only give more milk but also give milk of higher compositional quality.

The importance of a properly balanced concentrate-roughage ration in maintaining the level of fat and solids-not-fat was shown in a first lactation feeding trial in which six of the lowest testing cows in one herd became the highest. In a second lactation trial on the same cows, the results were more significant. While the overall herd average remained low, the experimentally fed cows continued to improve on the previous year's yield, and fat and solids-not-fat percentages.

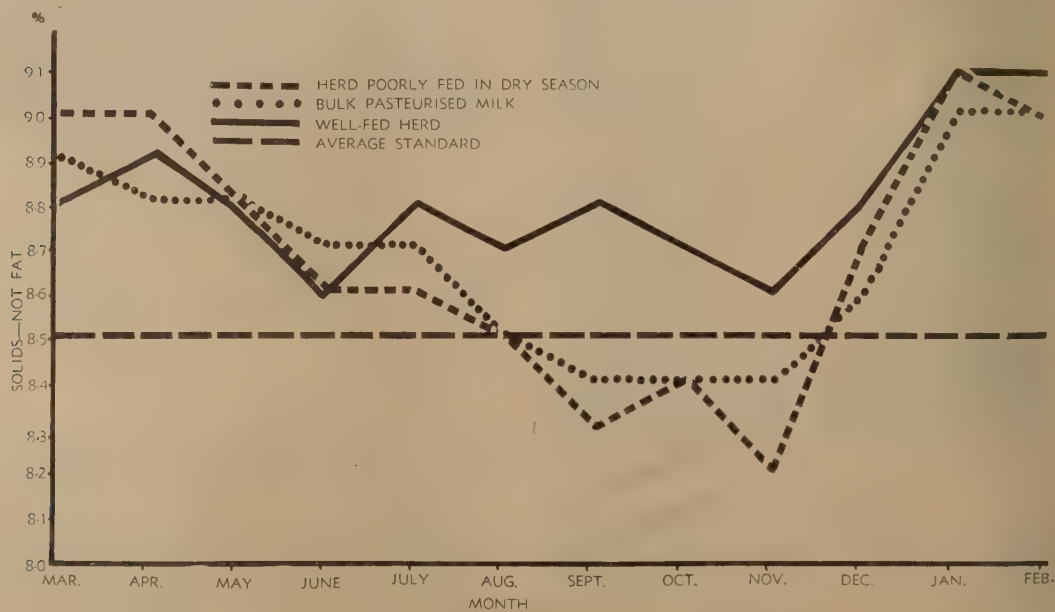


Plate 39.

Plate 39.—Effect of Level of Feeding on Percentage of Solids-Not-Fat.

The results obtained have confirmed that good quality roughage is necessary for the maintenance of the fat percentage of milk, while the improvement of the protein content of the ration is necessary to prevent the fall in the solids-not-fat percentage of milk (Plate 39). This work indicates the necessity on most farms for improvement in pasture management, including irrigated

pastures where practicable, fodder conservation, or feeding of concentrates during certain times of the year to maintain the chemical quality of the milk produced (Plate 40). The benefit accruing from such practices has been demonstrated on eight commercial dairy farms scattered throughout the State.



Plate 40.—An Improved Dairy Pasture on the Atherton Tableland in Use for Maintaining Milk Composition.

Keeping Quality of Pasteurised Milk

Investigations have continued on the effects of storage on the keeping quality of pasteurised milks. Changes in the total bacterial count, coliform count on desoxycholate agar, methylene-blue reduction time and taste and smell have been studied and correlated after storage of freshly pasteurised milks. The findings suggested very strongly that the keeping quality test should be modified for Queensland conditions and as a result the data have been examined with a view to formulating such a test. It is apparent that the temperature and time of incubation must be defined precisely and a temperature of 20 deg. C. for a period of 21-24 hours is suggested. In addition, it is proposed that the standard of the methylene-blue reduction time after incubation should be raised from $\frac{1}{2}$ hour to 2 hours. These modifications have been incorporated in the testing procedures and have proved very satisfactory.

The effect of low-temperature storage of pasteurised milks on the keeping quality test has also been investigated. The results obtained indicate the adverse effect of storage on keeping quality. Consequently, for standard conditions, the keeping quality should be determined on a chilled sample within two hours of processing.

Thermotolerant Organisms in Milk

The effect of thermotolerant organisms on the keeping quality of milks during storage has been studied. This work has shown that there is a relationship between the growth of thermotolerant organisms and the keeping quality of pasteurised milk, particularly after storage for 10 hours over temperature ranges from 5 to 35 deg. C. The results have shown that over these temperature ranges, the keeping quality test is a more sensitive measure of pasteurised milk quality than the bacterial count, and also that storage of raw-milk, at least under the conditions of the trial, results in a marked reduction in keeping quality of the pasteurised product.

Recombined Milk

Following the production of a palatable recombined milk last year, attention has been focussed on the design of a suitable type of processing plant for the production of such milk.

Recent experiments have shown that it is possible to produce a high quality product with an enhanced flavour using a modified formula and new processing techniques.

Serum Proteins in Market Milk

Knowledge of the changes in milk proteins, when milk is subjected to different kinds of processing treatment, is comparatively small. Consequently, the effects of storage, pasteurisation and refrigeration on the serum pattern are being investigated.

Antibiotics in Milk

Because of the possible effects of penicillin and other antibiotics on milk grading tests, cheese manufacture and the bacterial flora of milk, a survey of the incidence of residual antibiotics in milk supplies has been arranged in conjunction with the Health Department. Some preliminary work has been done using various identification techniques with the necessary sensitive strains of bacteria.

Evaluation of Detergents and Sterilants

Good dairy hygiene is necessary in the warm climate of Queensland to maintain milk or cream quality. The prevalence of hard water supplies also necessitates the use of suitable detergents for the efficient cleaning of dairy equipment. The suitability of a number of combinations of various detergents has been assessed in demonstrations on 18 farms. Many of the detergent mixtures can be eliminated for practical use on account of their excessive cost as compared with cheaper, yet equally effective, mixtures. The efficiency of a cheap alkali-acid technique has been demonstrated.

A number of new chemical sterilizing agents has been examined in the laboratory and field and some show considerable promise.

Farm Refrigeration

The more extensive adoption of cooling of milk and cream could be one of the most important factors in the improvement of quality of dairy produce. The high cost of farm refrigeration has limited its more widespread use and cheaper forms are being examined.

Five immersion types are under trial. Two of these combine drop-in cooling units with farm-built insulated concrete tanks and two make use of prefabricated cabinets. The other (Plate 41) has been designed by the Butter Marketing Board in co-operation with officers

of the Branch. This unit can be operated from a milking machine engine or by electricity. The satisfactory results achieved suggest that an efficient form of farm refrigeration is possible at a cost of £200-£250.

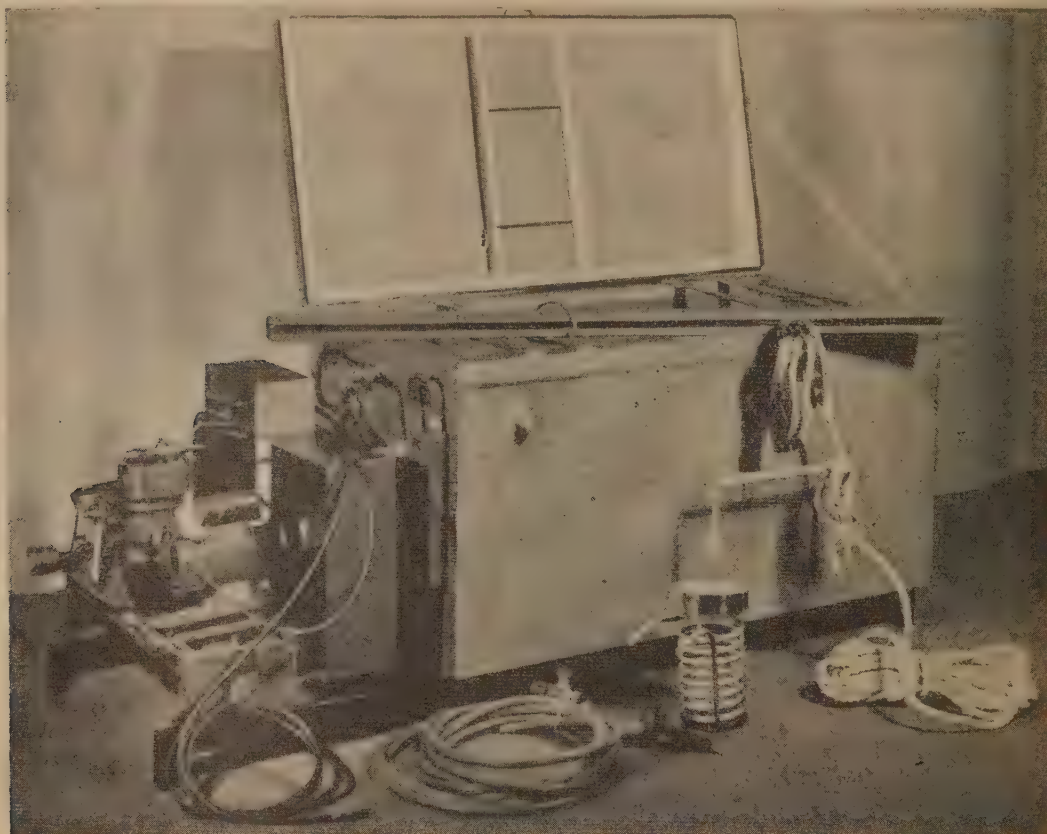


Plate 41.—A Cheap Farm Refrigerator of the Immersion Type for Cooling Cream.

Dairy Rubberware and Plastics

Investigations have continued into the quality of dairy rubberware. The benefits of a mixture of natural and synthetic rubber for inflations in giving longer use and more efficient milking have been shown in farm trials. To test the various types of rubbers under uniform conditions, special equipment has been installed. This will enable different aspects of the quality of dairy rubberware, the rate of milking of inflations of different compositions, and the effect of different field treatments to be more accurately assessed.

Some types of plastics which had been tested as substitutes for the long connecting rubbers on milking machines did not prove successful. However, a new type of polyvinyl chloride plastic tubing shows promise in trials which are being made.

Milking Rates

As fast milking is conducive to efficiency and higher yields of milk, experiments have been carried out with specially designed equipment to investigate the milking rates of cows under Queensland conditions. In preliminary work, it was found that there was wide variation in milking rates between cows and the rate of milking of the fastest cows at a 10-in. vacuum was greater than that of the slowest cows at a 16-in. vacuum. Other factors affecting milking rates are also being studied.

Other Investigations

These included studies on cryophilic bacteria in raw milk, the use of bacto-strips for bacterial counting, and a modified method for the detection of coliform organisms in pasteurised milk.

LABORATORY QUALITY CONTROL SERVICES

At Brisbane and three country centres, laboratory control services are provided to assist factories and extension officers.

Market Milk

The laboratory quality control of market milk has been carried out on a State-wide basis. Details of the work performed in comparison with the preceding year are set out in Table 1.

A total of 41 factory surveys was conducted.

Over 300,000 tests on farm milk supplies were carried out during the year by factories. The percentage of milks which failed the 4-hour methylene-blue test was 2.2, compared with 4.7 during the previous year. The factory staffs prepared microscopic slides from samples which failed a 4-hour standard and forwarded them to the laboratory for examination. The results of these examinations were made available to farmers and field officers to assist in correcting the causes of unsatisfactory tests.

There has been an increase in the number of methylene-blue tests carried out on bulk raw milks from country chilling factories because of the increased quantities of milk now being transported by tanker.

There has been an improvement in the chemical composition of raw milk as reflected in the lower percentage of samples which contained less than 3.3 per cent. fat, the minimum legal standard. This was 2.6 per cent., compared with 7.2 during the previous year. This result was due to the better seasonal conditions.

The amount of raw milk which is sold by vendors in Brisbane is steadily decreasing. Nevertheless, control of this milk has continued and more than 300 samples were tested.

The test for thermophilic organisms has been continued as a supplement to the methylene-blue test for improving

the quality of raw milk supplies intended for pasteurisation. This change in testing procedures has had the beneficial effect of steadily reducing the bacterial counts of bottled pasteurised milk. The improvement in the thermoduric counts of raw milk is shown by the fact that the percentage of such counts below 30,000 per ml. has increased from 46 per cent. in 1957-58 to 68 per cent. in 1958-59. There is, however, still room for improvement.

TABLE 1
SUMMARY OF MILK AND TABLE CREAM EXAMINATIONS

	1957-58	1958-59
Milk—		
Bottled pasteurised milk—		
Plate counts	1,783	1,691
Over 100,000 per ml. .. .	1,345	1,004
Coliform tests (10 ml. and 1 ml. levels)	3,348	3,272
Percentage positive in 1 ml. .. .	16.5	12.6
Phosphatase tests—		
Number	1,589	1,587
Percentage positive	0.31	0.06
Keeping quality tests—		
Number	685	972
Percentage of failures	2.4	0.1
Fat tests—		
Number	1,811	1,691
Average percentage	3.88	3.9
Solids-not-fat tests—		
Number	1,509	1,595
Average percentage	8.56	8.7
Freezing Point tests	630	1,419
Raw Milks—		
Raw milks from country depots—		
Methylene blue tests	7,181	7,691
Fat tests	7,120	7,788
Bulk tanker samples tested in laboratory—		
Methylene blue tests	467	555
Fat tests	460	579
Raw milk vendors —		
Methylene blue tests	359	315
Fat tests	359	311
Thermoduric counts on raw milk	12,040	9,483
Microscopic examinations	4,771	5,613
Cream—		
Bottled pasteurised cream—		
Plate counts	357	402
Over 100,000 per ml.	198	173
Coliform tests—		
Number	373	433
Percentage positive in 1 ml. .. .	56.8	47.6
Phosphatase tests—		
Number	363	416
Percentage positive	7.4	7.7
Fat tests—		
Number	370	378
Average percentage	37.45	37.55
Total number of tests in Branch laboratories	44,945	46,191

The quality of pasteurised milk was maintained at a high standard, as reflected in the results of tests which showed that almost 100 per cent. of all samples of bottled pasteurised milk were efficiently pasteurised. A similar result was obtained with the keeping quality test; only 0.1 per cent. of samples failed to reach the standard. There was also an improvement in the results of the coliform tests, an indication of a steady improvement in factory hygiene.

The average fat percentage was 3.9, which is slightly higher than for the previous year. Due to improved seasonal conditions compared with the previous year, an improvement was shown in the average percentage of non-fat-solids, which has increased from 8.5 to 8.7.

A total of 2,161 freezing point determinations was made on samples of raw and pasteurised milks from metropolitan and country areas. Some abnormalities were found to be due to traces of rinse water or chemical sterilants left on equipment, or the freezing of milk either in farm refrigerators or at the factory.

The percentage of samples of pasteurised table cream with bacterial counts above 100,000 per ml. and positive coliform tests has been significantly reduced. There is, however, still room for improvement.

TABLE 3
AVERAGE COMPOSITION OF CHEDDAR CHEESE

Year	Total Number Analysed	Moisture	M.F.F.S.	Fat	F.M.F.S.	Salt	S.M.
		%	%	%	%	%	%
1957-58	50	37.6	55.2	31.9	51.1	1.6	4.3
1958-59	62	36.4	54.7	33.4	52.5	1.6	4.5

M.F.F.S. = Moisture n fat-free substance.
F.M.F.S. = Fat in moisture-free substance.
S.M. = Per cent. salt in moisture.

In order to provide fresh milk in western areas of the State, the long-distance transport of bottled pasteurised milk in specially constructed refrigerated railway waggons has been under examination. Trial consignments gave good chemical, bacteriological and keeping quality tests after long-distance transport and the Railway Department has since provided some additional refrigerated transport for milk.

Cheese

Close contact has been maintained with cheese manufacturers in attempts to overcome their problems, and in this regard good use has been made of conferences, meetings, lectures and demonstrations. Features of the service provided for the cheese industry have included the distribution of cheese starter cultures, advice on manufacturing problems, analyses of samples and the carrying out of surveys.

Much improvement in body and texture faults in cheese has also taken place, due largely to the investigational work of previous years. However, there has been some falling off in the flavour score of cheese and this is the subject of research.

A total of 1,166 starter cultures was distributed in either the liquid or the freeze-dried state. The examination of the cultures under factory conditions has shown a higher incidence of contamination with bacteriophage. Some showed a short life and others produced cheese of above-normal pH. The relationship of these factors to the decline in cheese flavour is being closely examined.

A survey of the sources of extraneous matter occurring in cheese was carried out. It was shown that much of the extraneous matter was due to airborne material and direct contamination in the handling which the curd receives. A circular was sent to factories giving recommendations for the elimination of sources of extraneous matter in cheese. As a result, there was then greater care in manufacture and closely woven nylon filter cloths were used for the filtration of cheese-milk. This resulted in an appreciable reduction of extraneous matter in cheese.

Improved methods of packaging and presenting cheese were further developed by the industry. The success of packaging cheese and the tremendous wastage saved by eliminating rind formation have encouraged the rapid growth of the packaged rindless cheese trade. The increased sales of one company are shown in Table 2.

TABLE 2
LOCAL SALES OF RINDLESS CHEESE FROM ONE COMPANY

Month	Packaged Rindless
April, 1957	Nil
April, 1958	70,973
April, 1959	88,948

A trial of the effectiveness of eight different antimould paints in reducing mould growth on cheese factory ceilings and internal walls was commenced. Each has been applied to a portion of the ceiling of a factory. Periodic observations of the treated sections are being made and compared with two control areas on the same ceiling.

Some improvement has been achieved in the control of the composition of cheddar cheese, as indicated by the results of tests in Table 3.

A total of 120 visits was made to cheese factories for advisory and investigational purposes.

Butter

The Butter Improvement Service has provided information for both control and advisory purposes. A total of 23,715 tests was performed on 2,998 samples. Moisture and salt determinations were carried out on 2,124 samples of butter, of which only 12 (0.6 per cent.) were overmoisture. The average chemical composition was:—moisture 15.62 per cent., salt 1.35 per cent., curd 0.93 per cent., and fat 82.10 per cent.

There has been a steady decline during the past three years in the mean serum pH value. It was 7.65 in 1956-57, 7.50 in 1957-58 and 7.42 in 1958-59. This desirable trend should help reduce high fat losses in butter manufacture. The pH determination was made on 1,209 samples.

TABLE 4

	Well Worked	Fairly Well Worked	Rather Under-Worked	Under-Worked	Very Under-Worked
Number of Tests	1,253	419	260	136	81
Per cent. of Total	58.3	19.5	12.1	6.3	3.8

Considerable improvement has been shown in the extraneous matter tests, since most butter factories have provided some system for the filtration of cream. Results of 2,116 tests are summarised in Table 5 and depicted in Plate 42.

TABLE 5

	Clean	Fairly Clean	Dirty	Very Dirty
No. of Tests	569	1,408	129	10
Per cent. of Total	26.9	66.5	6.1	0.5

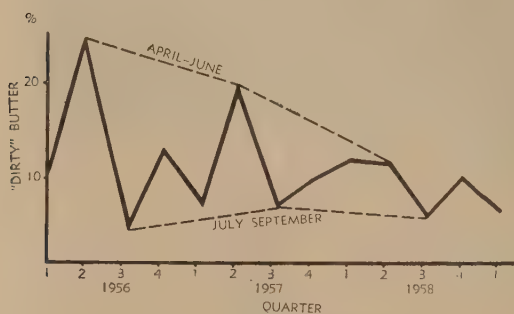


Plate 42.—Extraneous Matter in Butter has Decreased Since Cream Filtration has been Adopted.

Other examinations have included (a) the bacteriological quality, moisture droplet distribution and keeping quality of butter manufactured in rollerless all-metal churns; (b) the effectiveness of ultra-violet light in reducing bacterial counts in butter-wash waters; and (c) the proteolytic and lipolytic bacteria in relation to butter quality.

Fifteen bacteriological surveys and 54 other visits to factories were made in order to investigate various problems.

Analytical

A total of 6,390 samples, including brines, butters, cheese, cream, detergents, egg-pulp, margarine, powdered milk, salt and waters, was submitted for examination. The analyses of these samples involved the performance of 16,981 individual tests. They were connected with investigations, control services, and compliance with standards prescribed under the Dairy Produce Acts.

In a survey of water supplies, of 147 samples analysed, two factory water supplies were shown to cause severe corrosion of equipment and successful treatments were recommended.

Dairy Glassware

A total of 6,465 pieces of dairy glassware was tested for compliance with standards under the Dairy Produce Acts.

The bacteriological quality of butter has remained fairly constant in recent years, with a bacteriological quality index of 230 to 240. In the past year an improved result was obtained, the average from 2,109 tests being 271. The results reflect an overall improvement in the standard of factory hygiene.

Microscopic examinations for the size and distribution of the water droplets were performed on 2,149 samples of butter to check the standard of working. In 1957-58, only 63.7 per cent. of butters examined were described as well-worked or fairly well-worked. In the past year, 77.8 per cent. were well-worked. Table 4 summarises these results.

Although the overall percentage of rejections (8.4) compared favourably with previous years, the percentage of rejected dairy thermometers rose to 34 per cent. Improvement in the manufacturing processes would reduce such heavy rejections. The Standards Association of Australia has already prepared some standards for dairy glassware and their adoption throughout Australia should prove helpful in raising the standard of quality.

PUBLICATIONS, ETC.

Nineteen papers were prepared for publication, including four for the proceedings of the Fifteenth International Dairy Congress in London and seven for technical journals.

Seventeen radio talks were given and 18 addresses were prepared for conferences and field days.

Twenty-two press releases were prepared.

STATISTICS

Table 6 summarises research and laboratory quality control activities of the Branch.

TABLE 6
SUMMARY OF BRANCH ACTIVITIES

	Number of Samples	Number of Tests
Butter Improvement Service ..	3,158	24,835
Laboratory quality control of market milk	17,196	46,191
Analytical	6,390	16,981
Analyses associated with various research projects	18,245	51,009
Cheese starter cultures distributed ..	No. 1,166	
Dairy glassware tested	6,465	
Factory surveys	100	
Farm trials	166	
Research and advisory papers	15	
Radio talks	17	
Addresses, lectures, &c.	18	

STAFF

In order to keep the cheese industry abreast of developments in cheese technology and research, an officer has been chosen to spend four months in Europe. The Cheese Marketing Board is contributing towards the expenses of the officer and its decision is a reflection of the progressive outlook of the cheese industry.

The Senior Bacteriologist, Mr. V. R. Smythe, visited Thailand and the Philippines under the Colombo Plan Aid programme.

Another officer is completing her thesis on an aspect of dairy research work to satisfy the requirements of the Master of Science Degree. A total of three officers has now obtained higher degrees from research work undertaken in the Branch.

DIVISION OF MARKETING

The major work of the Division, which is concerned with marketing matters, farm economics, and standards of agricultural requirements and farm produce, proceeded satisfactorily during the year.

ECONOMICS RESEARCH

The continued downward trend in commodity prices during the year has emphasised the importance of paying close attention to the economics of farm management, if our rural industries are to compete effectively on the overseas markets of the world. When margins between costs and prices continue to fall, the necessity for readjustment becomes acute. This is a difficult problem for farmers to deal with, because the information necessary to guide decision making is often lacking. It has become necessary to develop ways and means of obtaining more information and devising effective analytical tools, so that the farmer can be helped to help himself meet the rapidly changing technological and market conditions in which farming has to be carried out.

It is against this background that the Economics Research Branch has been set up. Its object is to provide guide posts for the farmer, so that he can judge more accurately the economic implications of the various alternatives that are available to him. These alternatives may be in the nature either of a reorganisation of the farm enterprises, so as to substitute more payable crops or livestock products for those which have become unprofitable, or a change in the pattern of the organisation of the farm so that it can be conducted as a more efficient business unit.

This matter may entail increasing the size of the farm either in terms of acreage or in the investment of capital; or it may require a drastic reorganisation of the way in which machinery and labour are used on the farm. Any or all of these steps may necessitate the adoption of a more scientific approach to the problems of production, such as the provision by fodder conservation and soil conservation of adequate insurance against droughts and soil depletion.

Farming in Queensland is carried out under a diverse range of conditions, with a marked uncertainty of seasons in many districts, so that conclusions based on experience in one area are not necessarily valid for another area. However, following the general surveys carried out, we now have a background of experience which makes it possible to examine the economic implications of some of the production techniques available to farmers. It will help farmers to evaluate the possibilities for their own farms of techniques such as soil conservation, pasture improvement, irrigation, fertilizing, fodder conservation and more efficient feeding methods, if they have available details of the appropriate capital and labour requirements, and of the effect on the net income of the farm of adopting these techniques.

COMMODITY MARKETING BOARDS

A detailed description of the activities of the various marketing boards operating in Queensland will, as in previous years, be given in the Annual Report of the Director of Marketing to the Minister for Agriculture and Stock, as required by *The Primary Producers' Organisation and Marketing Acts, 1926 to 1957*.

MARKETING BRANCH

MARKETING BOARD ELECTIONS AND REFERENDA

During the year a new marketing board, the Onion Marketing Board, was constituted under the Primary Producers' Organisation and Marketing Acts. Growers did not request a referendum and the Board was constituted as from Mar. 1, 1959.

During the year, at the request of onion growers, an Onion Marketing Board was constituted under the Primary Producers' Organisation and Marketing Acts. Growers' marketing organisations in the State, including the C.O.D. and The Dairy Products Stabilisation Board, now number 18.

The importance of these organisations in rural industry can be gauged by the gross value of commodities handled by them. In recent years the figure has been as high as £57m. in 1955-56, out of a total rural production valued at £211m. In 1957-58, a drought year, the figures were £36m. out of £215m.

January 1959 saw the death at the age of 91 of one of the pioneers of organised marketing in Queensland in Mr. Henry Keefer. Mr. Keefer was chairman of the State Wheat Board from 1925 to 1929, a member of the first Cheese Board in 1923, and its chairman in 1924.

The death occurred in June 1959 of Mr. James Killoran of East Barron, Atherton. Mr. Killoran had been a member of the Northern Pig Board since January 1950, and he was a foundation member of his District Council of the Queensland Dairymen's Organisation.

Dairy marketing organisations were honoured during the year by the Knighthood conferred on Mr. Christopher Sheehy, in the Queen's Birthday Honours. Sir Christopher has been connected with grower-controlled marketing organisations for many years. One-time secretary of the State Wheat Board, secretary of the Council of Agriculture, and holder of various other offices, he has been chairman of the Australian Dairy Produce Board since 1952 and General Manager of the Commonwealth Dairy Produce Equalisation Committee Ltd. since 1937, and is secretary and general manager of the Butter Marketing Board.

STAFF

Reclassification in the Marketing Branch during the year resulted in the creation of three additional posts at Marketing Officer, Division I., level, with consequential promotions to Division II. The number of technical officers was increased by the transfer from the Tourist Bureau of Mr. K. N. P. Chester, B. Com.

With the approval of the Director of Dairying, the Senior Dairy Adviser at Warwick, Mr. D. S. Robertson, assisted, on a part-time basis, on economic research projects.

Mr. F. P. C. Bell, who had been an officer in Standards Branch since 1920, retired during the year.

Examinations were held by the Standards Branch in September 1958 which resulted in the appointment of five inspectors to adjust losses through retirements and other causes. The development that has taken place in recent years, in inspectional services and seed certification, necessitated the reclassification of certain posts, resulting in the creation of the following—Senior Inspector (Agricultural Standards), Senior Seed Certification Officer, and two inspectors, Division I. (Markets).

Ballots were held during the year for the election of growers' representatives on several marketing boards. Elections for the usual 3-year term were held for the following boards—Broom Millet, Central Queensland Egg, Grain Sorghum, Navy Bean, Northern Pig, Onion, and Peanut, and by-elections were held for the Barley, Tobacco Leaf, and Wheat boards.

In connection with the extension of operations of the Grain Sorghum Marketing Board, a referendum of growers was held, as a result of which the Board's operations were extended until Dec. 31, 1964. At the referendum 881 growers voted in favour of extension of the Board; votes against numbered 209.

Preliminary steps were taken to conduct a ballot for the election of members of the State Wheat Board, for the triennial term of office. In this connection, grower representation is to be increased from four members to six members, the two additional members to represent growers in the Western Districts and in the South Burnett and Central Districts. New areas will be delineated and growers' representatives will be elected on the ward system, instead of on the block system as hitherto.

PRIMARY PRODUCERS' CO-OPERATIVES

Although no new associations were registered under the Primary Producers' Co-operative Associations Acts during the year, established co-operatives continued to expand their operations and to play their important role in the rural community.

This is borne out by the fact that membership of primary producer co-operatives in Queensland now exceeds 100,000, while annual sales turnover has risen, in the last five years, from £30m. to more than £52m.

A significant trend in the last two years has been the closing down and winding up of a number of the smaller cheese co-operatives which have served the needs of dairy farmers in localised areas for many years. This tendency is attributed to two factors—the supply of milk to other dairy co-operatives for marketing as whole-milk, and the improvement of road communications, making possible the delivery of milk and cream to larger factories where it can be handled more economically.

MARKETING INTELLIGENCE SERVICES

The demand for crop information and market intelligence services continues to grow. Primary producers, financial institutions and business houses handling farmers' requisites and produce seek up-to-date information of this type. To meet this demand the Branch issued 37 separate forecasts and reports during the year, with a total circulation of 20,000.

ECONOMICS RESEARCH BRANCH

INVESTIGATIONS

During the year it was possible to begin a number of projects, some of which are now nearing completion. An economic survey of the wheat industry has been the major undertaking, and a report on this will soon be available. Other projects include dairy cattle feeding investigations, investigation into soil conservation economics, and various budgeting and recording procedures under Queensland conditions. A good deal of data and information has been collected from various farmers concerning input-output relationships, and costs of various farm operations such as silage making, tractor use, irrigation, clearing, boring, spraying and pasture establishment. This information is to be collated so as to provide basic data for budgeting purposes.

Wheat Survey

The economic survey of the wheat industry was begun last year in collaboration with the Council of Agriculture. The survey has as its major aim the definition of the economic problems associated with wheat growing in Queensland, particularly the economic relationships between wheat and the many crop and livestock enter-

A series of "Crop Reports and Forecasts" is issued during the growing period of the various crops, crops covered by this series including wheat, barley, oats, canary seed, linseed, grain sorghum, maize, white French millet, setaria (panicum), potatoes and peanuts. Quarterly reports are also issued on the poultry industry.

The past year was a period of consolidation in the preparation of these reports. The system in use relies on Honorary Crop Correspondents, who provide the Branch with information on the state of crops in their localities. This system was further extended during the past year, and it is hoped in time to have a complete network of correspondents throughout those areas where the above crops are grown. The grid upon which the sample of correspondents is based covers all the agricultural areas of south-eastern Queensland, but much work still remains to be done in the selection and appointment of correspondents in various sections of the grid.

Complementary to the crop forecasting service is the issue of a "Monthly Report on Production Trends" which gives in brief an account of production changes in all the State's crop and livestock industries, including those not covered by the "Crop Reports and Forecasts". An effort has been made to further improve the usefulness of this publication by drawing attention to particular industry highlights, and by giving clearer district pictures of production in the fruit and vegetable industry.

The monthly "Grain Abstracts" has been further developed, and an enlarged and more detailed report is now given on overseas grain and seed crop markets and on production and trade in oil crops. The changes in this publication were made to meet the need of the grain-growing industries for more detailed information, and the revised report has been well received by growers and their organisations.

The regular issue of "Daily and Weekly Market Reports" was continued. The daily reports are issued within a few hours of the close of selling, and the information therein is broadcast daily in the ABC "Country Hour" and by other radio stations, as well as being disseminated by the Press and this Department.

The call for prompt information on a wide variety of marketing problems is increasing. In addition to the regular published reports mentioned above, a large volume of information is provided in response to particular enquiries by farmers, marketing boards, business and other government departments.

Officers of the Branch gave two radio talks, and submitted nine articles for publication in the *Queensland Agricultural Journal*.

prises which are associated with wheat. An analysis is being made of the major factors which influence farmers' costs and returns.

It should be emphasised that this survey is in no sense a duplication of the work carried out by the Bureau of Agricultural Economics in connection with estimates of costs of production for the purpose of the Wheat Stabilisation Scheme. The purpose in this case is entirely different. Cost-of-production work is specifically orientated to obtaining a single figure which might receive acceptance as representing the cost of producing wheat.

In this work, emphasis is rather on the variations which exist in costs and returns under different conditions of farm size, geographical location and enterprise pattern. The many categories of wheat farmers in the wheat industry vary considerably in farm size and farm type, and each has its own particular problems. The survey will attempt to analyse the reasons for variations on farms where wheat is an important enterprise, so as to show the relative economic importance of the different crops and livestock products, the major factors influencing costs, and the nature of the farm management problem.

The field work for this survey, so far as the Darling Downs is concerned, has now been completed, and comprehensive data and information have been obtained from a random sample of 200 growers. This information is now being analysed and present indications are that some interesting aspects of the wheat industry will be defined more clearly than would otherwise have been possible.

The gathering of the necessary data and information has been marked by the ready co-operation of individual farmers, who have wholeheartedly assisted the field investigation teams to obtain an accurate and comprehensive picture of the situation on their farms. The data collected from individuals is confidential, but various groupings of growers have been made to establish general conclusions common to the various groups. The collation and analysis of the mass of data is a slow task but good progress is being made.

Dairy Cattle Feeding Study

A survey of the economic implications and relative profitability of major feeding practices on dairy farms in Southern Darling Downs districts was commenced towards the end of last year, and is continuing on a part-time basis. The investigation is designed to establish the relationships that exist between the size of the dairy enterprise, the feeding programme being followed, and the nature of the farm diversification, so that the influence of these factors on net income can be clarified and guidance given as to the most profitable method of farm reorganisation under present cost-price conditions.

The Southern Darling Downs is typically a mixed farming area and most farmers have a wide range of possibilities from which to select their enterprises. An important economic factor in mixed farming is the integration of dairy cattle feeding practices into the diversified farming pattern.

Information is being obtained by farm interview with prepared questionnaire. The enthusiastic reception of this work by co-operating farmers clearly illustrates the need for farmers to be provided with authoritative data on the economics of the various farm practices which they can adopt.

Winter Feeding Study

This limited investigation has continued throughout the year, in collaboration with the Cattle Husbandry Branch, with the object of determining the costs and returns associated with the production of wholemilk during the winter months on an intensive supplementary feeding basis.

A small group of suppliers in the Beaudesert district have been keeping detailed records relating to production, feeding, labour use, costs and returns, and co-operation by the farmers has been most gratifying. As the

initial period of 12 months for which the investigation was designed has expired, the records are now being analysed, and the report on the study will be available at an early date. If considered desirable, it will be possible to extend this investigation for a further period.

Soil Conservation Economics

A long-term project has been started, in collaboration with Soil Conservation officers of the Agriculture Branch, to evaluate the costs and returns of soil conservation practices. A number of farmers in the Wooroolin-Memrambi catchment area are now keeping records in prepared form relating to the costs of establishing protective earthworks, and showing details of production, costs, returns and labour use. Extension of this work to parts of the Darling Downs early in the coming year is expected.

This is essentially a long term-project, and worthwhile findings cannot be expected for some years. In the meantime, the practical problem is the maintenance of co-operation by farmers in the absence of quick results.

Budgeting Procedures

During the year advantage was taken of the offers of co-operation by various growers to further investigate an adequate procedure for farm budgeting under Queensland conditions. This work has produced beneficial results so far as the individual farmers are concerned, and considerable information and experience have been obtained from this work. Many requests are being received from farmers for assistance with their economic problems, but these can only be dealt with in a limited way owing to restrictions of staff and time. Consequently, only a small number of those who require help can be assisted.

Dairy Industry Economics

There is an urgent need for an examination of certain aspects of dairy farm economics, and preliminary work has been undertaken with a view to conducting a research project during the coming year. The major purpose of such an investigation would be to ascertain the economic implications of recommended practices, so as to define their applicability under various conditions more precisely than is now possible. Such an investigation would, of course, have to be suitably integrated with the investigations of the Dairy Industry Inquiry Committee, which will soon begin its work on a Commonwealth-wide basis.

GENERAL

During the year the Director served on two inter-departmental committees, one to examine certain aspects of the pineapple industry, and the other to examine a request by the Ginger Growers' Co-operative for a Government guarantee for bank finance.

STANDARDS BRANCH

The expansion of the services provided by the Standards Branch, which was a feature of the previous year, was maintained, and in some sections further progress was achieved.

The number of agricultural chemical preparations registered increased by 220, but the number of samples of seeds submitted for testing showed a slight decline. The inspectional services in fruit and vegetables were re-organised to provide greater supervision over the quality of these commodities being sold in retail shops, barrows and stalls. The inspection of agricultural chemicals has been directed largely towards sampling of stocks at the point of packing, where faulty lines can be detected before distribution.

Seed certification showed further progress, the production of certified hybrid maize being 5,102 bus. in excess of the previous year's figure. The 387 bus. of

certified French bean seed produced during the season was the greatest amount certified in any year since the inception of the scheme. The season also marked the production of the first certified buffel grass seed in Australia.

Officers of the Standards Branch contributed regularly to Departmental radio broadcasts and preparation of press releases, and an article entitled "Facts on Fertilizers" was published in the *Queensland Agricultural Journal*.

SEED TESTING

There was a decline of approximately 12 per cent. in the number of samples of seed submitted for testing. This was brought about partly by inspectors of the Branch concentrating their attention on stock foods and pest destroyers, and partly by merchants carrying

reduced stocks. The increases shown in the number of samples tested on behalf of farmers and in connection with seed certification are due mainly to seasonal influences and are not indicative of any particular trend. Considerable interest has been shown in the effect of seed treatments to control insect pests and diseases. This accounted for an increase of 465 in the number of samples submitted by other Branches for testing.

TABLE 1
SUMMARY OF SEED SAMPLES EXAMINED

Source of Samples	1957-58	1958-59
Inspectors of the Branch ..	3,361	1,904
Seed certification	189	332
Experimental projects	240	399
Submitted samples—		
(1) Merchants	7,301	6,364
(2) Farmers	175	360
(3) Government Departments	499	964
Total	11,765	10,323

A storage trial on sorghum and French bean seed showed that after 33 months in cold storage at a temperature of 40 deg. F. there was no loss of viability. Under ordinary storage conditions in Brisbane, sorghum seed begins to decline gradually in germination after 15 months, but beans at room temperature have shown no decline after 33 months. Storage in sealed tins and polythene-lined bags showed no improvement over storage in jute bags.

A conference of Australian seed testing officers was held in Sydney during April 1959 for the purpose of discussing problems in the techniques of seed analysis, and amendments necessary to the Model Seeds Act. Direction was also given to the Australian delegate to the Oslo meeting of the International Seed Testing Association on the action to be taken to meet Australian requirements. Queensland was represented at the Sydney conference by two officers of the Standards Branch.

SEED CERTIFICATION

The total of 15,556 bus. of hybrid maize seed certified in the 1957-58 season was considerably in excess of normal annual requirements, and it was anticipated that there would be a considerable carry-over of seed to the 1959-60 season. The acreage of hybrid maize crossing plots in the 1958-59 season was accordingly reduced. The reduced acreage appears to be having the effect of increasing the efficiency of the seed growers concerned, and as a result the total production for the 1958-59 season is unlikely to be reduced proportionately to the reduction in acreage.

The amount of certified grain sorghum seed produced in the 1957-58 season, coupled with a substantial carry-over of seed from the previous season, provided an ample supply of seed for sowing in the 1958-59 season. Certification of 3,684 bus. of grain sorghum seed was refused because of low germination, caused principally by excessive wet weather prior to harvesting.

Harvesting of 1958-59 grain sorghum crops for certification is not complete but indications point to excellent yields. This anticipated production, together with a fairly high carry-over of seed and the current low price for sorghum grain, is causing concern to some certified grain sorghum seed growers. However, market trends could change quickly, and it is felt that the present situation may be only of a temporary nature.

Following the successful bulk handling of one certified grain sorghum crop in the previous year, almost all certified sorghum seed producers on the Darling Downs used this method of handling their seed in the past season. Besides being a labour-saving means of handling seed, it also safeguards against seed contamination after harvesting.

Low germination led to refusal of certification of 723 bus. of sweet sorghum seed produced in the 1957-58 season. One registered area was not planted due to the area receiving insufficient planting rains.

A number of areas were registered for Sweet Sudan grass seed production last season. However, no seed was certified due to a number of causes such as insufficient planting rain, isolation requirements not being met, and crop destruction by disease. Production of this crop for certification purposes in the 1958-59 season is more promising, and at present a substantial quantity of seed is waiting to be cleaned before being submitted for certification.

Last season 387 bus. of bean seed were certified, and 93 bus. were refused certification due to low germination. Since 1954 all certified bean seed has been diverted to *bona fide* bean seed growers for the production of commercial bean seed. In 1958, Australia-wide over-production of commercial bean seed occurred, and this resulted in a reduced planting in Queensland in 1959 of bean seed for both commercial and certification purposes.

No tomato seed was produced for certification last season. Crops grown for this purpose met severe drought conditions and those reaching maturity were varieties of which reasonable seed stocks were held by seed producers. The crops were, therefore, harvested for the fresh fruit market.

Buffel grass seed certification met with only a limited success and only seed of the Gayndah strain was certified. A quantity of Biloela buffel grass was harvested but the germination was either too low or the seed contained too much inert matter to be accepted for certification.

TABLE 2
PRODUCTION OF CERTIFIED SEED

Crop	1956		1957		1958	
	Certi- fied	Re- fused	Certi- fied	Re- fused	Certi- fied	Re- fused
Hybrid Maize (bus.)	9,921	62	10,454	75	15,556	218
Grain Sorghum (bus.)	12,461	7,136½	29,476½	..	23,765	3,684
Sweet Sorghum (bus.)	1,395½	7½	552½	..	..	723
Sudan Grass (bus.)	1,182	305	401	429	..	4½
French Beans (bus.)	63	..	129½	28	387	93
Tomatoes (lb.)	165½	..	621½	..	..	..
Buffel Grass (lb.)	..	..	..	..	2,476	1,568

REGISTRATION

During the year, applications were received for registration, re-registration or extension of registration of 3,140 agricultural requirements, compared with 2,920 in the previous year.

The Agricultural Requirements Board, at 21 meetings, reported on the efficacy of 885 preparations—744 pest destroyers and 141 veterinary medicines. Of these, 19 pest destroyers and 2 veterinary medicines were refused registration.

A beginning has been made on the review of all stock food and fertilizer preparations. The formulations, in the main, are similar to those of the past but a number of high-energy poultry rations have been introduced.

A new miticide, 1,1 bis (chlorophenyl) 222—trichlorethanol (Kelthane), was released. This is an effective preparation for the control of red spider mite and has the advantage of low toxicity to humans. Dinitro (1 methyl heptyl) phenyl crotonate (Karatane), a specific control for powdery mildews, was added to the list of fungicides available in Queensland.

An organic phosphate, 2:3 dioxanedithiol — S — bis (o,o-diethylphosphorodithionate) (Delnav), is the latest introduction for cattle tick control.

Home gardeners are now being more specifically catered for by manufacturers, who are preparing small packs of pest destroyers with suitable directions for use. The labels on these packs are subject to the same scrutiny as the labels on the larger sizes normally used by commercial growers.

INSPECTION—AGRICULTURAL STANDARDS

Inspectors of the Standards Branch visited all parts of the State, including the far south-west and the far north. Inspections were made in 84 towns and 727 sellers of agricultural requirements were visited. This would indicate a slight decline in inspectional activities compared with the previous year, but this is accounted for by inspectors being occupied with the supervision of cleaning of seed for certification, supervision of cleaning of velvet beans imported from South Africa which contained prohibited seed, and the training of new inspectors.

Seeds

The most significant item in Table 3 is the 12,981 lb. of vegetable seed which was seized and destroyed or otherwise rendered unfit for sowing. While this is a considerable increase on the amount of vegetable seed similarly dealt with in the previous year, 11,040 lb. were in one lot of 184 bus. bags of French bean seed produced as commercial bean seed which failed to comply with the minimum standard of germination. It had been treated with an insecticidal dust, which rendered it unfit for feeding to stock, and consequently it was destroyed.

TABLE 3

ACTION TAKEN ON UNSATISFACTORY SEEDS

	1957-58	1958-59
Agricultural crop seeds cleaned under the supervision of an inspector	6,190 bags	2,297 bags
Destroyed or otherwise rendered unsuitable as seed—		
(i.) Agricultural crop seeds ..	60 bags	73 bags
(ii.) Vegetable seeds ..	364 lb.	12,981 lb.
(iii.) Packeted seeds ..	697 pkts.	1,020 pkts.
Processed for stock foods—		
(i.) Agricultural crop seeds ..	715 bags	460 bags
(ii.) Vegetable seeds ..	696 lb.	..

Material other than Seeds

Inspectors paid special attention to the quality of stock foods, fertilizers, limes, pest destroyers and veterinary medicines offered for sale. Table 4 summarises the action taken on these materials.

During the year no action was necessary with regard to fertilizers or limes, which suggests that quality control by fertilizer firms is quite satisfactory.

The aggregate of samples taken declined to 681 from 780 last year. There was a slight reduction in stock food and veterinary medicine samples, but a considerable increase in the number of pest destroyer samples. Of 535 inspectors' samples analysed by the Agricultural

Chemist, 72 showed some deficiency. These were mostly pest destroyers or stock foods. In the case of stock foods, action was taken against the manufacturers to ensure the non-repetition of such deficiencies. In connection with pest destroyer samples showing deficiencies it was found necessary to seize 3,656 packages. More than 3,400 of these represented 1 gal. tins of hormone weed killer. An investigation revealed that the processor of this material had misinterpreted the manufacturer's guarantee figure for one of the constituents, and action was taken to have the whole of the batch reprocessed to raise the standard to that guaranteed.

Daily inspections of arrivals of hay, chaff and other produce at Roma Street Railway Yards were maintained throughout the year. Considerable quantities of hay and chaff were detected containing impurities prescribed as harmful ingredients under the Agricultural Standards (Stock Foods) Regulations and, wherever practicable, permission was given to pick over the trusses of hay to remove the offending material.

In many instances seizure was followed by requests from growers for the return of their produce for their own use. All such requests were refused as there was reason to suspect that in many cases the offending goods would have been re-consigned to areas where regular inspections are not practicable. The legislation is designed to afford protection to buyers, by ensuring that stock foods available for feeding their livestock are of satisfactory quality, and by preventing the introduction of weeds, in some cases poisonous ones, into areas which might otherwise be weed-free.

INSPECTION—FRUIT AND VEGETABLES

During recent years there has been a gradual change in the method of conveyance of fruit and vegetables to market. Road transport is now receiving increased patronage at the expense of the railways. This has created additional difficulties in the inspection of produce, particularly potatoes and onions, because receiving depots are not now located at a central point. To cope with this change, arrangements have been made for inspectors equipped with motor transport to regularly visit all produce depots in the Metropolitan area. Three additional depots have been approved as places for the sorting of potatoes, onions and pumpkins which have been found, on inspection, not to comply with the provisions of the Fruit and Vegetables Act.

Increased attention has been paid to the inspection of fruit and vegetables in retail shops, barrows and roadside stalls, as by far the greatest number of complaints concerning the quality of fruit and vegetables offered for sale comes from this quarter.

Complaints were received from growers of fruit and vegetables concerning rough handling of their produce by carriers at the markets. A special survey was made of the markets to observe methods of handling between the hours of 8 p.m. and 7 a.m. and this has been followed up by periodic inspections. Handling of these commodities at the markets is now considered satisfactory.

TABLE 4

SUMMARY OF ACTION ON MATERIAL OTHER THAN SEEDS

	1957-58						1958-59					
	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total	Fertilizers	Lime	Pest Destroyers	Veterinary Medicines	Stock Foods	Total
Samples received from—												
Inspectors	90	5	126	61	498	780	84	5	209	29	354	681
Buyers	..	..	..	..	7	7	..	..	2	10	10	12
Seized	983 (a)	..	622 (b)	9 (b)	529 (a)	..	..	..	3,656 (b)	10 (b)	523 (c)	..
	44 (b)				23 (b)							
					339 (c)							
Reconditioned, re-labelled or deficiency rectified	983 (a)	..	611 (b)	..	529 (a)	..	..	..	3,452 (b)	..	68 (a)	..
					54 (c)						500 (c)	..
Destroyed	23 (b)	..	55 (b)	9 (b)	18 (b)	..	..	..	224 (b)	5 (b)	669 (c)	..
					285 (c)							
Withdrawn from sale ..	..	..	31 (b)	..	..	31 (b)	..	..	..	5 (b)	..	5 (b)

(a) Bags.

(b) Packages, tins or bottles.

(c) Trusses of hay.

In November 1958 an interstate conference of technical officers was held in Melbourne to discuss the adoption of uniform grade standards for potatoes in all States, and recommendations made to the Australian Agricultural Council were approved. Appropriate amendments to the Queensland regulations will be considered during the forthcoming general review of these regulations.

To meet changing conditions in the fruit industries the regulations relating to the grade standards for apples, apricots, peaches and tomatoes were amended prior to the 1958-59 deciduous fruit harvest. The revised standards have proved in practice to meet growers' requirements more effectively than did the previous standards.

IMPORTS AND EXPORTS

Imports of seeds, particularly agricultural seeds and grass seeds, were much larger than in the previous year. It was necessary to clean imported Centrosema seed due to the presence of giant sensitive plant. Velvet bean imports were on a reduced scale compared with the previous year, but quality was considerably improved; shipments from South Africa containing prohibited seed of maize were few in number.

TABLE 5
IMPORTS—SEED FOR SOWING

Agricultural Seeds—				Bags
Centrosema	..	..	..	20
Clover	..	..	..	101
Lupins	..	..	..	403
Mangel	..	..	..	26
Rape	..	..	..	20
Vetch	..	..	..	50
White French Millet	..	..	..	16
				636
Grass Seeds—				Bags
Bahia Grass	..	..	..	45
Browntop	..	..	..	10
Ryegrass	..	..	..	40
				95
Velvet Beans				5,496 bags
Vegetable Seeds—				lb.
Beet	..	..	..	459
Cabbage	..	..	..	146
Carrot	..	..	..	275
Cauliflower	..	..	..	96
Celery	..	..	..	14
Corn, Sweet	..	..	..	28
Cucumber	..	..	..	370
Kohl Rabi	..	..	..	6
Lettuce	..	..	..	135
Marrow	..	..	..	63
Melons	..	..	..	186
Parsley	..	..	..	9
Pumpkin	..	..	..	61
Radish	..	..	..	15
Rhubarb	..	..	..	7
Turnip	..	..	..	14
Swede	..	..	..	52
				1,936
Peas				284 bags

Numerous analyses were carried out on behalf of exporters of grains and small seeds. A lucrative market in the United States of America for *Paspalum dilatatum* accounted for 4,299 bags amounting to 506,660 lb., an increase on the already high figure for the previous year.

TABLE 6

EXPORTS—GRAINS AND SEEDS

Samples		Quantity	
Barley	.. 43 representing	{	248,658 bags plus 38,567 tons in bulk
Beans	.. 11	..	621 lb.
Buffel Grass	.. 1	..	3 lb.
Canary Seed	252	..	37,859 bags
Carpet Grass	5	..	345 bags
Centrosema	6	..	2,759 lb.
Couch Grass	3	..	88 lb.
Cowpea	.. 34	{	4,153 bags plus 17 tons in bulk
Green Panic	4	..	1,012 lb.
Guinea Grass	3	..	275 lb.
Japanese Millet	.. 22	..	4,461 bags
Lucerne	.. 1	..	10 lb.
Maize	.. 10	..	35 bags
Molasses			
Grass	.. 3	..	6,904 lb.
Paspalum	35	..	4,299 bags
Peanuts	.. 85	..	6,652 bags
Peas	.. 1	..	2 bags
Phasey Bean	1	..	10 lb.
Pigeon Pea	1	..	120 lb.
Prairie Grass	2	..	11,220 lb.
Rhodes Grass	9	..	24,227 lb.
Setaria italica	.. 215	..	42,883 bags
Sorghum	.. 7	{	133 bags plus 593 tons in bulk
Sunflower	46	..	3,102 bags
Townsville Lucerne	6	..	1,458 lb.
White French Millet	.. 652	..	195,947 bags
Total	.. 1,458		

All fruit and vegetables exported from Queensland were inspected before loading, and certificates were issued with respect to their condition. Consignments of fruit and vegetables imported into the State, comprising mostly apples, pears, grapes, potatoes and onions, received careful inspection at the place of discharge.

TABLE 7

EXPORTS—FRUIT AND VEGETABLES

Apples	..	..	29,604	cases
Apricots	..	..	9	..
Avocadoes	..	..	1	..
Grapefruit	..	..	123	..
Grapes	..	..	248	..
Lemons	..	..	105	..
Mandarins	..	..	343	..
Oranges	..	..	2,791	..
Passionfruit	..	..	1	..
Peaches	..	..	64	..
Pears	..	..	2,062	..
Plums	..	..	9	..
Tomatoes	..	..	1,119	..
Beetroot	..	..	5	bags
Cabbages	..	..	307	crates
Capsicums	..	..	24	cases
Carrots	..	..	287	bags
Cauliflowers	..	..	68	crates
Celery	..	..	162	..
Cucumbers	..	..	104	cases
Garlic	..	..	38	bags
Lettuce	..	..	168	cases
Onions	..	..	2,683	bags
Onions	..	..	1,404	crates
Parsnips	..	..	87	..
Peanuts	..	..	50	bags
Peas	..	..	32	..
Potatoes	..	..	2,223	..
Potatoes	..	..	1,686	crates
Potatoes/Seed	..	..	53	bags
Pumpkins	..	..	181	..
Radishes	..	..	5	cases
Rhubarb	..	..	34	..
Swedes	..	..	48	bags
Turnips	..	..	7	..
Total	..	..	46,135	packages

CLERICAL AND GENERAL DIVISION

Mr. W. T. Gettons, who has been Assistant Under Secretary of the Department since 1946, retired from this position on July 2, 1959.

Mr. Gettons joined the Public Service in 1910. He held various positions in the Department, including that of Accountant from 1936 to 1946. Other positions to which he was appointed included that of Registrar, Farm Produce Agents Acts, Deputy for the Chairman of the Brisbane Milk Board during any absence of the latter, and member of the Queensland Meat Industry Board. He has now been appointed Acting Chairman of the Queensland Meat Industry Board and General Manager of the Metropolitan Abattoir during the absence overseas of Mr. T. G. Hope, the Chairman and General Manager.

STAFF

On June 30, 1959 there was a total of 1,283 on the Department's staff, compared with 1,235 at the same date in 1958.

The clerical staff comprises 236 officers, as follows:—

—	Brisbane	Country	Total
Clerks	89	1	90
Clerk-Typists	74	58	132
Male Assistants	8	1	9
Female Assistants	4	1	5
Total	175	61	236

This total of 236 falls short of immediate Departmental requirements by 20. There are 11 vacancies in Brisbane and nine in country centres and at Experiment Stations. These vacancies exist because of resignations and the need for additional assistance owing to the expanding activities of the Department and also for the purpose of relieving country technical officers of clerical duties, thereby permitting the latter to devote more time to their field work.

The Records Branch continues to handle a large volume of correspondence each year. During the year just ended, 88,345 inward letters were received and 10,035 intra-mural memoranda and 54,581 outward letters were dealt with—a grand total of 152,961.

Photo-copying was again in demand, including work carried out by Records Branch staff for other Departments.

ACCOMMODATION

The Central Administration of the Department is now located in offices formerly occupied by the Bureau of Sugar Experiment Stations. The present accommodation, with all of the staff occupying adjoining rooms, is much more convenient than the arrangement which previously existed. The Department of Public Works made an excellent job of reconditioning the offices, which are painted in pastel shades and provide very pleasant working conditions.

The re-allocation of space on the ground floor will, when reconditioned and painted, afford some measure of relief to other Branches. There is still, however, a great shortage of office space in the Department and it is a constant problem to find accommodation for the annual increase in staff numbers.

Extensions to the Court House at Kingaroy have provided some additional space but there is still insufficient room to meet the needs of the Departmental staff in this important centre, and in view of the appointment of additional technical officers it has been necessary to renew the lease of the offices in private premises.

Extensions to the Court House at Emerald and to the Departmental office at Nambour are almost ready for occupation. The Stock Inspector at Toogoolawa has moved into a new room which was added to the Court House.

A lease has been obtained of four rooms in private premises in Mareeba to house Departmental officers who were formerly located at the Court House. Plans have been prepared for a new building at Mareeba. It is anticipated that work on the new building will be commenced in the coming year.

Officers at Wandoan who were occupying leased premises have moved to the Lands Office building. The lease of premises which were occupied at Killarney was terminated and officers of the Department now occupy premises leased from the Fire Board.

It is anticipated that the Forestry Department will be moving out of the Court House at Dalby in September. Some relief from the existing overcrowding should then be afforded when the space in the Court House is re-allotted.

Extensions have been obtained to the lease of premises at Southport and Cooroy. The lease of premises at Winton has expired, but the Departmental officers continue to occupy these premises on a weekly tenancy basis.

ACCOUNTS

Expenditure from all Funds amounts to £3,529,913, as against £3,768,662 during the previous 12 months.

The total receipts from all Funds were £2,304,247, compared with £2,525,074 in 1957-58.

Included in the 1958-59 figures quoted above are the expenditure and receipts for sugar bulk handling facilities, which were £493,876 and £237,918 less, respectively, than those for 1957-58.

FARM PRODUCE AGENTS ACTS

The *Farm Produce Agents Acts*, 1917 to 1952 provide for the registration of all persons who receive consignments of farm produce for sale on commission, or for or in expectation of any fee, gain or reward on the owner's behalf, and for the supervision of their dealings with their principals.

Growers who forward farm produce to agents should satisfy themselves that such agents are licensed under the Act before consigning produce to them.

Various agents' books of account and other records were checked during the year to ensure that such agents were complying with the Acts and correctly accounting to their principals for all consignments received.

There are 120 licensed farm produce agents and of these 70 are in the Brisbane area.

TRANSPORT

Of the 44 new vehicles purchased during the year, 33 were to replace vehicles which had reached the stage where they could not be operated economically and which had been recommended for disposal, and three were to replace vehicles owned by Departmental officers which were no longer available for use for official purposes. The remainder were additions to the fleet.

Six of the new vehicles were purchased from the Commonwealth Extension Services Fund and two from the Commonwealth Dairy Industry Extension Grant.

During the year 22 vehicles were sold and a further 22 vehicles are being held awaiting disposal.

Departmental vehicles in service at June 30, 1959 numbered 287, whilst a total of 237 officers operate their privately owned vehicles for official purposes on a mileage basis.

EXTENSION SERVICES

Induction training in extension methods was provided for a number of new appointees to the extension staff of various Branches.

Sixty-four officers attended the two 12-day in-service schools in extension methods which were held during the year. Most of those attending the school were full-time extension officers, but some supervising officers and a number of technical and scientific officers were also present. The latter included research personnel with a view to facilitating the flow of information from research centres to the farming communities.

By arrangement with Commonwealth authorities, 14 Indian sheep and wool officers studying in Australia under the Colombo Plan were given a training course in extension methods.

The extension co-ordination staff co-operated with various Branches in film production, design of displays and leaflets, conduct of field days and various other activities. A commercial artist was employed throughout the year on literature illustration and other artwork.

The central tape broadcasting service widened the range of its operations during the year and 15 broadcasting stations are now receiving a tape each week. The tapes now take the form of four one-minute talks on topical subjects. This tape service is supplementary in some areas to broadcasting sessions provided by local officers.

CENTRAL LIBRARY

The Central Library of the Department continued to receive and file numerous periodicals and pamphlets from all parts of the world. It also acted as the clearing house for a large amount of incoming material for Branch libraries and for Departmental exchanges with scientific institutions.

Arrangements are in hand for the Public Library of Queensland to provide the staffing of the Central Library. It is expected that continuous staffing with trained personnel will be one of the advantages of this arrangement.

PUBLICATIONS

A slight increase has been shown in the circulation of the Department's monthly advisory publication for farmers, the *Queensland Agricultural Journal*. Where there had been a falling off in subscribers from 15,000 down to 13,000, due largely to the increased subscription rate, this decline appears to have been arrested, and an increase of 300 has occurred in the last few months. Steps are being taken to bring circulation up to the former level, and possibly higher. To this end, a campaign has begun, which so far has embraced two major steps:

- (1) Increase in variety, scope and readability of the journal's contents;
- (2) promotion of circulation through the use of planned media.

Main items in the planned media mentioned in (2) were the placing of journal display racks on the walls of 12 country centres; the use of the Department's regular radio feature, "Agricultural Digest," to give previews of journal articles, and the use of Queensland country newspapers for the same purpose.

The number of reprints from the journal increased by 25 per cent. More than 86 journal articles were re-issued as advisory leaflets or pamphlets, and the total number of copies printed amounted to more than 17,000. The articles originated in the Division of Animal Industry (47), Division of Plant Industry (29), Division of Dairying (9), and Division of Marketing (1).

Editing was completed early in the year of Volume II. of the Queensland Agricultural and Pastoral Handbook series.

Publication of *The Honey Flora of South-Eastern Queensland* was made during the year.

The provincial press has continued to make wide use of the Department's weekly News Bulletin. This bulletin carries topical advisory items for primary producers and is sent to nearly 100 newspapers and radio stations. Newspapers have used the material regularly, and those publishing a weekly "farmers' page" have displayed them prominently. In addition, a summary of the three weekly items has been widely circulated over Australian Broadcasting Commission stations.

Use of the press as an extension medium has been enlarged by supplying special feature articles to selected newspapers. These have in appropriate instances been effectively illustrated and have met with a favourable response from newspaper editors. So far there has been no difficulty in having them placed at approximately quarterly intervals. Wide distribution has been possible.

News reports covering current activities of the Department were released almost every day to the press and radio. As in the instances of the news bulletins and feature articles, these releases were given space in country newspapers, while metropolitan papers, too, gave them prominence in most cases.

PHOTOGRAPHIC SECTION

Over 800 jobs, covering work required by every branch of the Department, were completed and over 21,000 prints of all sizes and of a very wide range of subjects produced. A large proportion of this total was prepared from negatives taken in the field all over the State by members of the staffs of the various Branches. There is a steadily growing demand for colour slides of scientific subjects of many kinds, and over 900 Kodachromes were taken in the studio and elsewhere by the Section's officers. In addition, 280 35 mm. black and white slides were made.

A central film library consisting of 48 optical sound 16-mm. movie films, in either colour or black and white, has been established, and is kept in the care of the Section.

Advantage of the movie equipment now available is being taken by various Branches to record in movement and colour a number of subjects where the aspects of animation are important.

A short film dealing with the effect of heat on eggs has been completed for the Poultry Section.

W. A. T. SUMMERVILLE,
Director-General and Under Secretary.